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TIMBER RESOURCE REVIEW

CHAPTER I
TIMBER RESOURCES FOR AMERICA'S FUTURE

A SUMMARY OF THE TIMBER RESOURCE REVIEW

(Not to be Listed)

(Preliminary Review Draft Subject To Revision)

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INDEX TO TIMBER RESOURCE REVIEW REPORTS AND APPENDIX MATERIAL

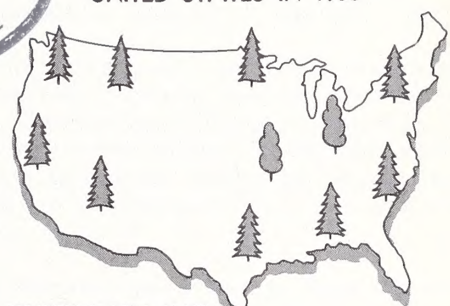
(Each Chapter and each Section, in the case of Chapters IV and IX, is a separate document)

CHAPTER I. TIMBER RESOURCES FOR AMERICA'S FUTURE

A Summary of the Timber Resource Review

(Preliminary review draft subject to revision)

THE FORESTS OF THE UNITED STATES IN 1953



INCLUDING COASTAL ALASKA

664 MILLION ACRES TOTAL FOREST

489 MILLION ACRES COMMERCIAL FOREST

2057 BILLION BOARD FEET SAWTIMBER

47 BILLION BOARD FEET NET ANNUAL GROWTH

13 BILLION BOARD FEET ANNUAL MORTALITY

49 BILLION BOARD FEET ANNUAL CUT

By:

Edward C. Crafts

September, 1955

FOREWORD

Tomorrow the Nation's need for timber will be strikingly greater than it is today or at any time in the past. And we have the potential to meet that need if we fully apply our forestry knowledge and skills promptly and with the utmost vigor and determination.

That, in brief, is the essence of our findings in this comprehensive appraisal of the timber situation in the United States, started by the Forest Service in 1952 and now ready for preliminary release and review.

For many years the Forest Service has periodically examined the forest situation as part of its over-all responsibility to keep the people and the Congress informed as to timber supplies and outlook. This Timber Resource Review is the sixth of these "State-of-the-Union" reports on timber--one of the Nation's most important renewable natural resources. As was true of each of its predecessors, this report is more reliable and more comprehensive than any of its forerunners, due to improved technical skills and the availability of more information.

Although the natural resources of the United States have received much study in recent years by various commissions, States, the Congress, educational institutions and others, there has been no assembly of new forest resource information for the entire country since the appraisals made by the Forest Service and the American Forestry Association in 1945. Since then better timber inventory information has become available; there has been a decade of timber cutting and growth. Impressive strides have been made in forestry and in wood utilization. The outlook for the future economy of the United States has changed greatly, particularly with respect to population. These and other changes make this report timely.

The planning and field surveys in connection with this study were carried out with the advice and assistance of a great many organizations and individuals, especially the State Departments of Conservation or Forestry and forest industries. Grateful acknowledgment to these collaborators is made later. The Forest Service accepts full responsibility for the factual data and the views expressed in the report. It could not have completed this study with its own limited facilities, and, because of the collaboration that has been received, the study was better conceived, more complete, and more soundly executed.

This report is a review draft prepared by a small group of Forest Service analysts assigned to the task. It is intended mainly for in-Service review, and for our advisers, collaborators, key public officials and legislators. Except for Chapter I which is the summary, only 1,500 copies of the individual chapters were made. Three thousand copies of Chapter I were made. Copies are available to anyone while the supply lasts. Comments are invited and will be carefully considered in preparation of the final report, which will get under way shortly.

I hope that this study will add to America's leadership in forestry, that it will be useful to other nations of the world in relating our timber situation to theirs, and that it will serve as a basis for long-range forestry planning for progressive forest industries and for State governments and the Federal Government. I believe it will convince the reader that we are not faced with an acute timber shortage in the United States. I earnestly hope that it will also convince you that we face a tremendous challenge if we are to grow enough timber so that our children may enjoy the timber abundance that we ourselves have known.

Richard E. McArdle

RICHARD E. McARDLE
Chief, Forest Service

ACKNOWLEDGMENT

This review of the Nation's timber resources was made by the Forest Service with the help of a great many experts in State and private forestry agencies, forest industries, conservation organizations, and other agencies in the Federal Government. The participation of these collaborators is described in the first part of the report. Their advice in planning the project and their assistance in assembling the facts of the timber situation are gratefully acknowledged.

Appreciation is also expressed to the many professional people in the Forest Service who participated in the Timber Resource Review. In addition to those named as authors in the separate chapters and subchapters of this report, a large number of others on the national forests, in research centers, in regional offices and experiment stations, and in the Chief's office, took part in planning the review, collecting and compiling field data, and preparing preliminary analyses and interpretations. Because so many helped as part of their regular work and because individual efforts and responsibilities varied so widely, it is not possible to list all who deserve credit nor would it be equitable to mention some without mentioning others. The authors are particularly indebted to the statistical clerks who tabulated and checked the data, and to the editors, secretaries and draftsmen whose assistance in completing the manuscripts was invaluable.

Special mention should be made of Leonard I. Barrett, Project Leader, George F. Burks, Assistant Chief, Division of Forest Economics Research, and John R. McGuire, Forest Economist.

Edward C. Crafts

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TIMBER RESOURCES FOR AMERICA'S FUTURE

A Summary of the Timber Resource Review

INTRODUCTION

The report of the Timber Resource Review is in the nature of a "State-of-the-Union" message by the Forest Service on our national timber supplies. This comprehensive appraisal of the timber situation in the United States was started early in 1952. About a year and a half was devoted to planning the project, a year to field surveys and collection of data, and a year to compilation, interpretation and preparation of this report.

The Timber Resource Review is the latest in a series of overall timber appraisals in which the Forest Service has shared. The most recent one prior to this study was in 1945. One of the unique features of the present undertaking is that it was planned and executed in the field with the widespread collaboration of a great number of States, forest industries and individuals. Although this has engendered some delays, they have been more than offset by better planning, more intensive surveys than the Forest Service could have undertaken by itself, and it is hoped by more widespread understanding and acceptance of the factual results.

PURPOSE AND SCOPE

The chief purpose of the Timber Resource Review is to provide a stock-taking of the current timber situation in the United States and a look into the future with respect to prospective timber supplies and needs. Because forestry is a long-time undertaking, the current situation in timber carries perhaps more than the usual implications as to our future supplies. The basic facts on forest land areas, timber volumes, growth and utilization, timber quality, forest protection, forest ownership, productivity of land, prospective requirements, and related information are essential tools in the formation of forest policy on a national, State and local basis by both public and private institutions.

In part, the Timber Resource Review may be construed as discharging some of the responsibility delegated by the Congress to the Secretary of Agriculture in connection with the nation-wide Forest Survey. The Congress has directed the Secretary, under such plans as he determines to be fair and equitable, to cooperate with the appropriate officials of each State, and either through them or directly with private and other agencies to make a comprehensive survey of the present and prospective requirements for timber and other forest products in the United States, and of timber supplies, including a determination of present and potential productivity of forest land. He is also directed to obtain such other facts as may be necessary in the determination of ways and means to balance the timber budget of the United States. (McSweeney-McNary Forest Research Act of May 22, 1928, as amended, 16 U.S.C. 581a-i). The Secretary is also directed to acquire and diffuse among the people of the United States useful information on subjects connected with agriculture in the most general and comprehensive sense of that word. (Department of Agriculture Organic Act, May 15, 1862 (5 U.S.C. 511).)

Since its inception the Forest Service has felt the Timber Resource Review to be a timely undertaking. It believes that the significance of the facts that are subsequently presented, as well as the outlook for the future support that view.

Among the reasons for undertaking the Timber Resource Review in 1952 were the following: (1) The availability of new post-war information from the nationwide forest survey on forest areas, timber volumes and growth on about half of the Nation's forest land. This information showed substantial changes and yet the rate of progress of this survey for the remainder of the country was such that it was deemed inadvisable to postpone appraising the national picture for a considerable additional period. (2) Changes,

both currently and prospectively, with respect to our national economic setting in terms of such over-all criteria as trends in population and gross national product. These and related factors placed completely new orientation on prospective needs for timber products. (3) The post-World War II period appeared to mark a rapid acceleration in American forestry. Thousands of private forest owners showed heightened interest in timber growing. There was fuller utilization of the timber harvest. New gains were achieved in forest protection. The impact of these and other changes in the national forestry effort pointed toward a new look at the timber situation. (4) The international situation indicated that United States resources, particularly in softwoods, needed to be considered in relation to those of the free world rather than the entire world.

At the outset it is well to clarify the scope of the Timber Resource Review with respect to exclusions as well as inclusions. The present draft of this report is in 9 chapters, the first of which is an introduction and summary, and the last of which is a series of appendices.[1] The summary chapter does not attempt to brief the vast array of statistical information assembled in this report. It is more in the nature of an analytical appraisal and high-lights of the findings which, in the course of their presentation, require summarization of a significant amount of factual material. Likewise, in the appendix, where the basic statistics are presented in more detail than in any other chapters, there is more information available on a State basis than was possible to present in the more generalized chapter discussions. The presentation of more data by States is one of the unique features of the Timber Resource Review that distinguishes it from its predecessors. The other is the degree of collaboration in both the planning and execution with States and forest industries.

The Timber Resource Review is an appraisal of the <u>timber</u> situation as distinguished from the <u>forest</u> situation. In other words, the orientation of this project has been with respect to timber supplies and needs in the Nation's economy. Not considered in this report is the utility of our timber resources for watershed management, recreation, wildlife, or other purposes. The multiple-use values of our forest stands, which in numerous instances may transcend the utilitarian timber values, have not been appraised.

The Timber Resource Review is not a duplication of the appraisal made by the Forest Service and the American Forestry Association in 1945. It differs somewhat in scope, definitions, in utilization standards, in methodology, and in other ways. Coastal Alaska is included as an integral part of the United States. At the outset there arose the question whether to duplicate the 1945 Reappraisal and thus obtain more direct comparisons and better trends, or whether to change procedures, definitions, and other details in order to provide a better survey and thus sacrifice comparability. The latter was the course chosen.

At no place is there appraisal of the action of public agencies or individuals or groups of individuals as desirable or undesirable, nor is there appraisal of intent or motives. The factual data on timber volumes, forest area, protection, planting and productivity are related to conditions on the ground--not to actions resulting in the conditions found.

The Timber Resource Review does not offer recommendations nor a program for American forestry. It does provide the base for program formation and an opportunity and challenge to both public and private groups to reconsider certain basic forestry policies and programs. The Forest Service believes that any program for American forestry which might evolve from the Timber Resource Review, either by the Forest Service, by State groups or by private groups, will be more soundly conceived if it is predicated on review and discussion of the results of this study by all interested citizens and groups.

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[1] See inside of front cover for Chapter organization.

PROCEDURES AND COLLABORATION

Procedures

The procedural phases of the Timber Resource Review have involved four principal phases: (a) planning, (b) field surveys and assembly of data, (c) data compilation and interpretation, and (d) report preparation.

The planning phases, particularly, were characterized by a great deal of group and individual consultation. An informal national advisory group consisting of the following organizations was established.

- American Farm Bureau Federation
- American Federation of Labor
- American Forestry Association
- American Paper & Pulp Association
- American Pulpwood Association
- Association of State Foresters
- Congress of Industrial Organizations
- Council of Forestry School Executives
- Farmers Union of America
- National Grange
- National Lumber Manufacturers Association
- Natural Resources Council of America
- Society of American Foresters

Some of these agencies participated much more actively than others in the two general planning meetings which were held in April, 1952 and January, 1953. In addition, representatives of the Departments of the Interior and Commerce participated in one or both of these meetings and were most helpful.

Following the first meeting of the advisory group, a smaller working group was named to collaborate with the Forest Service in preparation of its working plans. Following the meeting with the working group, preliminary working plans were developed and distributed for review purposes to key individuals throughout the country. Many individual discussions were held concerning these plans, and there were four general area meetings in Atlanta, Georgia; Milwaukee, Wisconsin; San Francisco, California; and Philadelphia, Pennsylvania, at which these preliminary working plans were reviewed in detail. The preliminary plans were substantially revised as the result of this widespread review, and a second meeting of the advisory group which was held in January, 1953. Following this meeting the final working plan was developed, and completed in the summer of 1953. Thus about one and a half years were devoted to the planning phases of the Timber Resource Review. By this procedure plans for the project were greatly strengthened and the basis was laid for effective cooperation in the field surveys.

The field surveys and assembly of data occupied about a year and consisted of five principal phases: (a) Timber inventory and growth surveys; (b) utilization surveys; (c) productivity surveys; (d) assembly of other resource data; and (e) requirements projections.

The inventory and growth surveys were conducted under the leadership of the Forest Service regional forest experiment stations, and involved three classes of work. First, there were 17 States in which the forest survey had been completed since January 1, 1947. For these the survey findings were accepted without additional field work, and were adjusted by simple bookkeeping to January 1, 1953. Second, there were 15 States in which forest survey field work was in progress and which were judged to be sufficiently advanced to furnish a base for extension to the remainder of those States with some supplementary field observations. Third, there were 16 States and Coastal Alaska in which it was necessary to conduct special surveys to obtain reasonably reliable estimates of the current resource situation. These may have involved adjusting original forest survey data or special surveys based on other than forest survey data.

In the utilization surveys, data were developed by the forest experiment stations usually in cooperation with the States. State cooperation was especially widespread in the Northeast. Although Bureau of Census data on output of lumber, veneer logs and

bolts, and pulpwood were used as the overall control, supplementary surveys of varying intensity were made to obtain reliable estimates by States and geographic source of logs and bolts. Field surveys were also made as a basis for estimating the output of other timber products and the quantity and use of plant residues.

Productivity surveys were limited to an examination of recently cut commercial forest lands. These lands were examined according to predetermined system and criteria which were developed locally in collaboration with State foresters and others. The statistical control for the productivity surveys was intended to provide reasonably reliable data on a regional basis, although in some instances it was intensified as the result of collaboration by State agencies to provide equally reliable data on a State basis.

There was a great deal of additional resource information assembled on protection, planting, ownership, financial and economic factors, and forestry assistance programs. This information was not derived from new and original surveys but from reports available to the Forest Service, or to State foresters, and through consultation and other sources.

The information on factors influencing past consumption of timber products and future requirements for timber was based in part on field surveys, such as that conducted by the Forest Service for 1948 on wood used in manufacture, and to a great extent on economic and statistical reports of various Federal and State agencies, particularly the Departments of Labor and Commerce. The recent work of the Stanford Research Institute provided many helpful guides in the field of requirements.

Inventory estimates for Interior Alaska were developed in collaboration with the Department of the Interior. Those for Canada were based largely on reports of the Dominion and Provincial Governments of Canada. Those for Mexico were based on a variety of sources, and those for other nations of the world on reports made by the various countries to the Food and Agriculture Organization of the United Nations.

As noted earlier, about one year was devoted to compilation, interpretation and preparation of this report. Following review of the present preliminary draft, publication of the final report is planned.

Collaboration

Already mentioned has been the very significant assistance received by the Forest Service from various sources, without which completion of the Timber Resource Review would not have been practicable.

The advice and counsel of the national advisory group has been of inestimable value. Also not subject to evaluation are such items as the basic information made available by State agencies and forest industries on such items as timber products output and forest fire experience. Valuable time and effort were contributed by a great many people in discussions throughout the country at meetings and in other ways in counseling during the planning phases of the Timber Resource Review.

In addition to such help, there have been tangible contributions to the field execution of certain phases of the project, such as the field surveys in utilization, in timber inventory, and in productivity of recently cut lands. Valued at more than half a million dollars these outside contributions consisted roughly of 78 percent manpower,[2] 13 percent facilities and equipment, and 9 percent cash. They came from the following sources:

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[2] Man-months valued at $500.

Task	States	Forest industries[1]	Other Federal agencies[2]	Total
Timber utilization	$ 18,900	$ 500	$ 100	$ 19,500
Timber resource inventory	160,100	92,600	2,300	255,000
Productivity of recently cut lands	168,700	23,900	25,700	218,300
Other tasks[3]	6,800	--	5,800	12,600
All tasks	$354,500	$117,000	$33,900	$505,400

1 Including consulting and other privately employed foresters.
2 Including also a small amount of contributions not elsewhere classified.
3 Mainly forest protection and planting.

The most significant contributions were made by State agencies and totaled 70 percent of all such assistance. State assistance was about equally divided between the inventory and productivity tasks, and was made by 65 State agencies in 37 States, including 36 State Departments of Forestry or Conservation, Extension Services in 12 States, 2 State Agricultural Experiment Stations, 10 State-supported educational institutions, and 5 other State agencies.

Forest industry contributed about 25 percent of total assistance. Industry's greatest contribution was to the inventory phase although significant help was also made available in the productivity survey. A total of 149 forest industry sources assisted in the Timber Resource Review, of which 40 percent were lumber companies, 25 percent pulp and paper companies, and the balance about equally divided between other wood-using companies and industry trade associations, consulting and other privately employed foresters.

Principal assistance from other Federal agencies was from the Bureau of Land Management and National Park Service, Department of the Interior; Soil Conservation Service, Department of Agriculture; and Department of the Army.

Not included in the above summary was the cooperation extended by countless landowners in permitting access to their properties in connection with either the inventory or productivity field surveys. With very few exceptions such access was wholeheartedly given.

It should be emphasized that the compilation of data, its interpretation and report preparation are that of the Forest Service. Collaboration on the Timber Resource Review in any way, either through service on one of the advisory groups, through positive assistance as reflected in the preceding tabulation, or through merely making available access to one's property or individual production records in no way commits the collaborators to support either the statistical or interpretive results of this report.

It should also be emphasized that information obtained in connection with the Timber Resource Review by the Forest Service on individual properties or individual output records is considered and treated in the same confidential manner as are statistics made available to the Bureau of the Census. Information on individual properties is utilized within the Forest Service only for Timber Resource Review purposes, and is available only to a small group of individuals working on the Timber Resource Review project. No information relative to individual enterprises has been or will be released except: (1) to a participating public agency whose authorized employee collected the information in question. This is done on the basis that presumably the agency will already have that information from field forms completed by its employee; and (2) upon the written request of the individual whose property is involved.

EARLIER REVIEWS OF THE TIMBER SITUATION

Most of the earlier national reviews were prepared either by the Forest Service or other Executive Branch agencies, by governmental boards or commissions, or by committees of the Congress. Following is a list of the principal reports on our timber situation which might well be considered as predecessors to the present report, beginning with a report by the Department of Agriculture in 1909 on "The Timber Supply of the United States." This comprehensive list is included because a number of these reports have tended to be forgotten with the passage of time.

1909 (1909)* Kellogg, R. S. The Timber Supply of the United States. U. S. Dept. Agr., Forest Service. Cir. 166. 24 pp., illus.

1911 (1911) U. S. Dept. Commerce and Labor, Bur. Corps. Summary of Report on the Lumber Industry, Pt. 1, Standing Timber. 38 pp., illus. (The "Bureau of Corporations Report")

Part I, Standing Timber (including summary), 301 pp., illus. (1913)

Part II, Concentration of Timber Ownership in Important Selected Regions. (1914)

Part III, Land Holdings of Large Timber Owners (with ownership maps). 264 pp., illus. (1914)

1920 (1920) U. S. Dept. Agr., Forest Service. Timber Depletion, Lumber Prices, Lumber Exports, and Concentration of Timber Ownership, Rpt. Sen. Res. 311, 66th Cong. 2d Sess. 71 pp., illus. (The "Capper Report")

1923 (1920) Greeley, W. B., Clapp, E. H., et al. Timber: Mine or Crop? U. S. Dept. Agr. Yearbook 1922, pp. 83-180, illus.

1924 (1922) Clapp, Earle H. and Boyce, Charles W. How the United States Can Meet Its Present and Future Pulpwood Requirements. U. S. Dept. Agr., Dept. Bul. 1241, 100 pp., illus. (The "Clapp-Boyce Report")

1932 (1930) U. S. Dept. Agr., Forest Service. The Forest Situation in the United States (A Special Report to the Timber Conservation Board). 46 pp., illus. (processed)

1933 (1930) U. S. Dept. Agr., Forest Service. A National Plan for American Forestry. Sen. Doc. 12, 73d Cong., 1st sess. 2v., 1,677 pp., illus. (The "Copeland Report")

1934 (1930) National Resources Board Report. Forest Land Requirements and Available Resources. pp. 135-143, illus. Forest Land Problems and Policies, pp. 207-216, illus.

1935 (1930) U. S. Dept. Agr., Forest Service. Forest Land Resources, Requirements, Problems, and Policy. Pt. VIII, Supplementary Report of the Land Planning Committee to the National Resources Board, 114 pp., illus.

1935 (1930) Curran, C. E., and Behre, C. E. National Pulp and Paper Requirements in Relation to Forest Conservation. Sen. Doc. 115, 74th Cong., 1st sess. 74 pp., illus. (The "Hale Report")

1939 (1938) U. S. Dept. Agr., Forest Service. A National Forest Economy: One Means to Social and Economic Rehabilitation. 296 pp., illus. (processed)

1940 (1938) March, R. E., and Gibbons, W. H. Forest Resource Conservation. U. S. Dept. Agr. Yearbook 1940, pp. 458-488, illus.

1941 (1938) U. S. Cong. Joint Committee on Forestry. Forest Lands of the United States. Sen. Doc. 32, 77th Cong. 1st sess. 44 pp., illus. (The "J. C. Report")

1948 (1945) U. S. Forest Service. Forests and National Prosperity. U. S. Dept. Agr. Misc. Pub. 668, 99 pp., illus. (The "Reappraisal Report")

Report 1. Gaging the Timber Resource. 62 pp., illus., 1946; rev. 1947. (processed)

Report 2. Potential Requirements for Timber Products. 70 pp., illus., 1946; rev. 1947. (processed)

Report 3. The Management Status of Forest Lands. 29 pp., illus., 1936; rev. 1947. (processed)

Report 4. Wood Waste. 45 pp., illus., 1947 (processed)

Report 5. Protection Against Forest Insects and Diseases. 39 pp., illus., 1947; rev. 1938 (processed)

Report 6. Forest Cooperatives. 18 pp., 1947. (processed)

1952 (1945) President's Materials Policy Commission--Making the Most of Timber Resources. In Resources for Freedom, Vol. 1, pp. 36-45.

1952 (1945) U. S. Dept. Agr., Forest Service. Domestic Timber Resources. Rept. 5 in Vol. V, Resources for Freedom, President's Materials Policy Commission.

*Dates in parentheses are years to which data are applicable.

Only a few of the above-listed reports were based upon new field data--the others were based largely upon reanalysis, restatement and reemphasis of data previously published. The four reports which are most noteworthy from the standpoint of incorporating new data and thus being milestones in appraising our timber supply are the so-called "Capper Report" of 1920, "Copeland Report" of 1930, the report on "Resource Conservation" for 1938, and the "Reappraisal Report" for 1945. The Timber Resource Review reports fall in that category and incorporate the first new timber resource information reported by the Federal Government since the 1945 Reappraisal. The Forest Service considers the periodic preparation of these over-all national appraisals as part of its regular work and continuing responsibility.

In addition to the Federal reports listed above, there have been significant contributions to our knowledge of the timber situation and requirements for timber, prepared under the auspices of research institutions or conservation groups. The most notable of these is the "Report of the Forest Resource Appraisal," prepared by the American Forestry Association. This was an appraisal of our timber situation, based upon field surveys made at the same time as the 1945 Reappraisal of the Forest Service. There was cooperation between the two surveys and remarkable agreement as to the resource facts. Subsequently the American Forestry Association reported on the "Progress of Forestry," and more recently the Stanford Research Institute has completed a careful study of "America's Demand for Wood." Following are these three citations:

1946 Woods, J. B. Report of the Forest Resource Appraisal. American Forests 52: 413-28. (Reports for many individual States appeared in American Forests 1945-49).

1951 American Forestry Association. The Progress of Forestry, 1945 to 1950. 90 pp., illus.

1954 Stanford Research Institute. America's Demand for Wood. 1929-1975. A Report to Weyerhaeuser Timber Company. 404 pp., illus. Summary 94 pp., illus.

There are many other reports relating to forest policy, organization of forestry agencies, reports on individual States or portions of States. But it is believed the above two lists incorporate the principal national reports on timber inventories and requirements.

A FAVORABLE NATIONAL SETTING

In any attempt to appraise timber resources for the future, some assumptions as to future conditions must be made. For example, estimates of prospective demand for timber products cannot be developed except within the framework of certain economic assumptions, nor can prospective supply estimates be developed without certain assumptions as to trends in forestry. The future role of wood in the national economy is related to both demand and supply factors. Hence it is necessary to make a choice between such basic assumptions as peace or war, prosperity or depression, population growth or decline, and rising or falling standards of living.

GENERAL ECONOMIC FACTORS

The key assumptions to which the Timber Resource Review is geared are: Peace but continued military preparedness, a rapid rise in population, economic prosperity and high living standards as reflected in a much larger gross national product, continuation of present trends in forestry, and continued importance of forest products as a basic raw material.

One of the most fundamental of all assumptions is that population of the United States in 1975 will be 210 million or 53 million more than the Census Bureau estimate of 157 million in 1952 and 45 million more than in 1955. This and certain other basic assumptions are shown below.

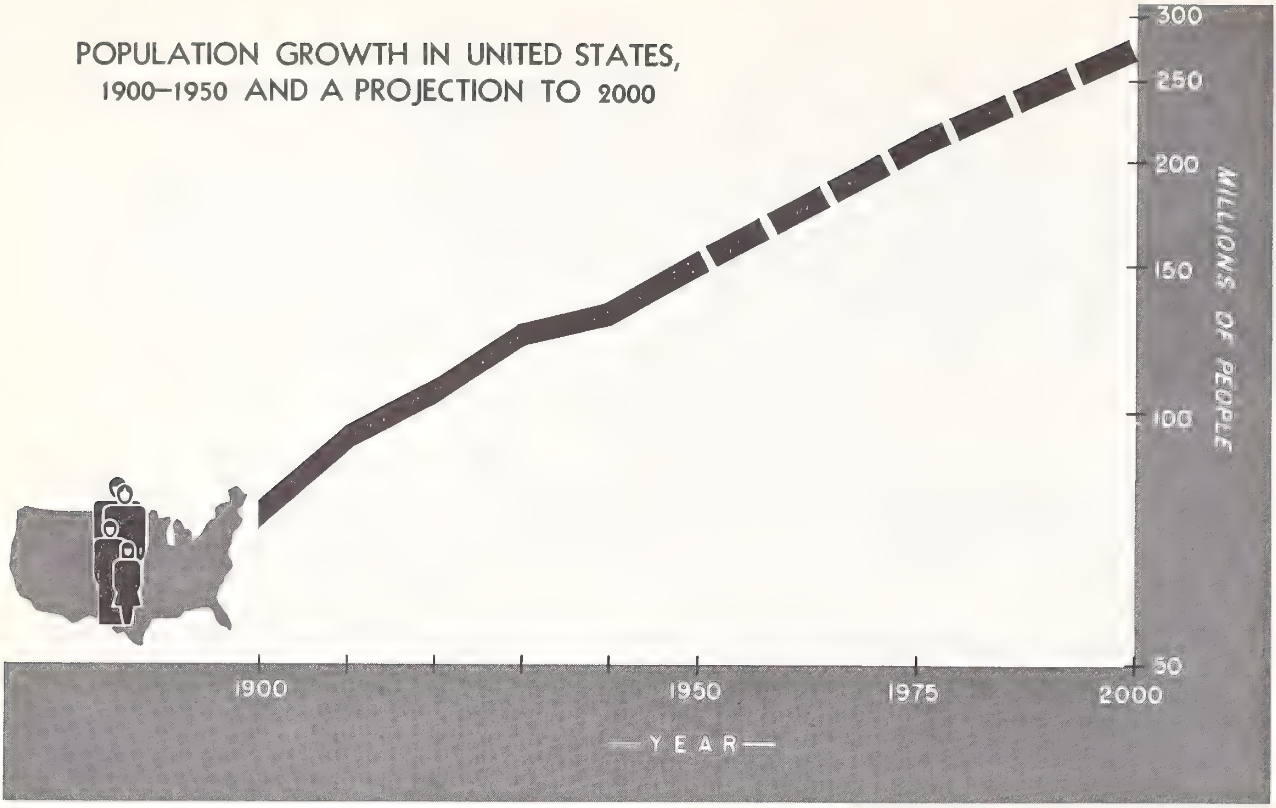
	1952	1975	2000
Population (millions)	157	210	275
Gross national product (billions of 1953 dollars)	$365	630	$1, 200
Civilian employment (millions)	61	78	100
Consumption of new physical-structure raw materials (billions of constant dollars)	$6	$8	$12

The 1975 estimate lies about midway between two "medium" projections made by the Bureau of the Census for that year. The estimate of 275 million for the year 2000 lies about midway between the highest and lowest estimates that are obtainable by extending the Bureau of Census 1975 projection. Insofar as can be judged from trends between 1950 and 1955, the population assumptions appear to be conservative. The projected rate is at about the same rate as the rate of population increase during the first half century (fig. 1).[3]

The 1945 Reappraisal report of the Forest Service, accepting the population projections current at that time, assumed 145 million for 1950, whereas the Bureau of the Census later enumerated 154 million as of 1950. Likewise, the Reappraisal indicated a population of 167 to 185 million by 2000. This is roughly 100 million persons less than the present midpoint in Census Bureau projections of 275 million. This difference in population forecasts is one of the fundamental reasons for the differences between projected requirements made by the Forest Service in its 1945 report and the estimates developed in the Timber Resource Review.

Assumptions have also been made with respect to the employed civilian labor force, degree of unemployment, the general strength of the Armed Forces, the length of the

[3] Many of the charts and graphs appearing in this review draft have not been reduced to size intended for final printing.



RATIO SCALE: Equal vertical distances denote equal percentage change

Figure 1

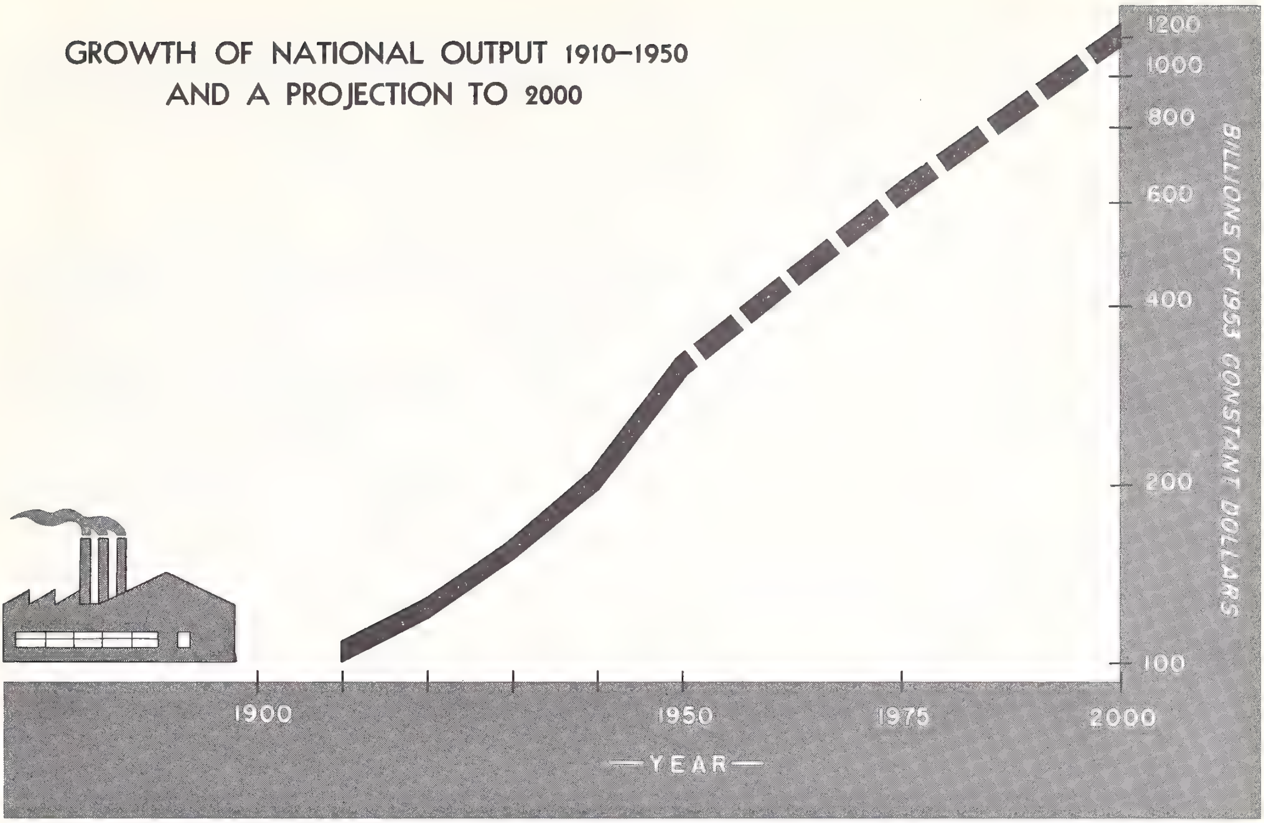
work-week and average productivity per man-hour. The civilian labor force is estimated to increase from 61 million in 1952 to 78 million in 1975 and 100 million in 2000. Unemployment is estimated to average somewhat less than 4 percent of the civilian labor force, resulting in a high level of employment. Armed Forces are estimated to be maintained at about their 1953 strength. The work-week, which averaged 40.2 hours in 1953, is estimated to average about 35.0 hours in 1975 and 32 hours by 2000. Man-hour productivity is estimated to increase at a rate of about 2.4 percent per year in the 1953-75 period and 2.1 percent annually in the 1953-2000 period. This compares with the rate of 2.5 percent annually which has prevailed in the 1940-53 period.

On the basis of the above factors, the gross national product--which is the total national output of all goods and services--is estimated to increase nearly 100 percent in the 1950-75 period or to a total in 1975 of 630 billion dollars at 1953 prices (fig. 2). Even with a further reduction in the average work week and a somewhat lower annual average increase in man-hour productivity, gross national product would rise to $1,200 billions by the year 2000. While these appear to be large increases, they are no greater than conservative projections of what has actually happened in the economy of the United States during the past 50 years.

Another important economic factor which reflects the standard of living is disposable personal income, both total and per capita. It is assumed that total disposable personal income (personal income after taxes) will rise from $250 billion in 1953 to $433 billion in 1975 and to $826 billion by 2000. The per capita counterpart is $1,567 in 1953 rising to $2,062 in 1975 and $3,004 in the year 2000.

One of the most significant economic factors in appraising demand for forest products is the annual intake or consumption of raw materials. During the first half of the twentieth century, raw material requirements increased considerably faster than population. This was a reflection of the rise in standards of living and may be detected most readily by comparing the slope of the curves for particular periods in figures 1 and 3.

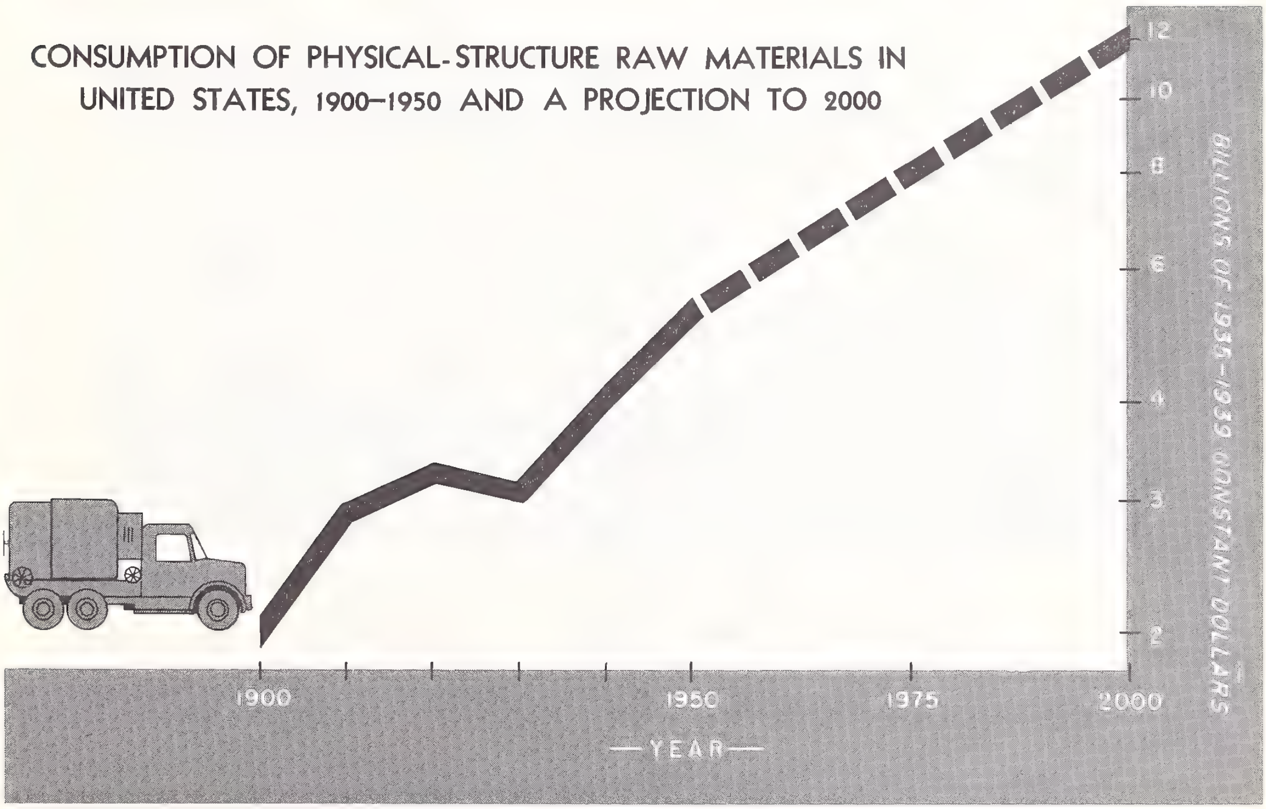
GROWTH OF NATIONAL OUTPUT 1910–1950 AND A PROJECTION TO 2000



RATIO SCALE: Equal vertical distances denote equal percentage change

Figure 2

CONSUMPTION OF PHYSICAL-STRUCTURE RAW MATERIALS IN UNITED STATES, 1900–1950 AND A PROJECTION TO 2000



RATIO SCALE: Equal vertical distances denote equal percentage change

Figure 3

The intake of physical-structure raw materials (raw materials other than food and energy materials) is assumed to increase 105 percent between 1952 and 2000 as contrasted to an increase in population of 75 percent for the same period. The per capita increase in physical-structure raw materials is estimated at 14 percent in the 1950-75 period and 28 percent in the 1950-2000 period.

TIMBER IN THE NATIONAL ECONOMY

Consumption trends, including consideration of substitution of other products for wood and vice versa, is considered in the projection of demand for forest products. Here the purpose is to summarize only a few general criteria which indicate the widespread dependence of our economic structure on timber products.

Timber-connected activity in 1952 accounted for 6 percent of the civilian labor force, 6 percent of compensation paid to all employees, and 5 percent of our national income, as these estimates[4] show:

	Total	Timber-connected
Civilian employment (millions)	61	3.4
Compensation of employees (billions)	$195	$11
National income (billions)	$290	$15

Timber-connected employment totaled 3.4 million man-years in 1952 and was heaviest in the fields of lumber manufacture, pulp and paper manufacture, and timber construction (table 1).

Table 1.--Timber-connected employment in the United States, 1952

Activity	Employment	
	Thousand man-years	*Percent*
Timber-based industries:		
Forestry	65	2
Lumber	655	19
Pulp and paper	504	15
Wood furniture and fixtures	310	9
Total	1,534	45
Other timber-connected activities:		
On farms	300	9
Timber construction	700	20
Rayon and other wood chemicals	236	7
Timber product transportation	228	7
Timber products trade	400	12
Total	1,864	55
All activities	3,398	100

Source: U.S. Dept. of Commerce. National Income, 1954 ed. Washington, 1955, and other Department of Commerce Sources.

[4] Based upon U.S. Dept. Comm. National Income, 1954 ed., Washington, 1955, and U.S. Dept. Comm. and U.S. Bu. Census sources.

Purchases of lumber and wood products and pulp and paper products are widely distributed in the economy as shown by the following listing. This merely confirms the well known fact that wood and wood derived products are among the most common of everyday substances.

Sector of the Economy	Purchases: Billion dollars	Purchases: Percent
Construction	2.5	26
Trade and services	1.2	13
Printing and publishing	1.1	11
Food and clothing industries	1.0	10
Chemical industries	.5	5
Furniture and radio industries	.4	5
Other manufacturing industries	1.0	10
Households	.4	4
Exports	.3	3
Undistributed	1.3	13
All sectors	9.7	100

Another important index of the role of timber products in our national economy is the proportion they comprise of our total mix of physical-structure raw materials (fig. 4). During the early 1900's timber products (other than fuelwood) comprised close to one-

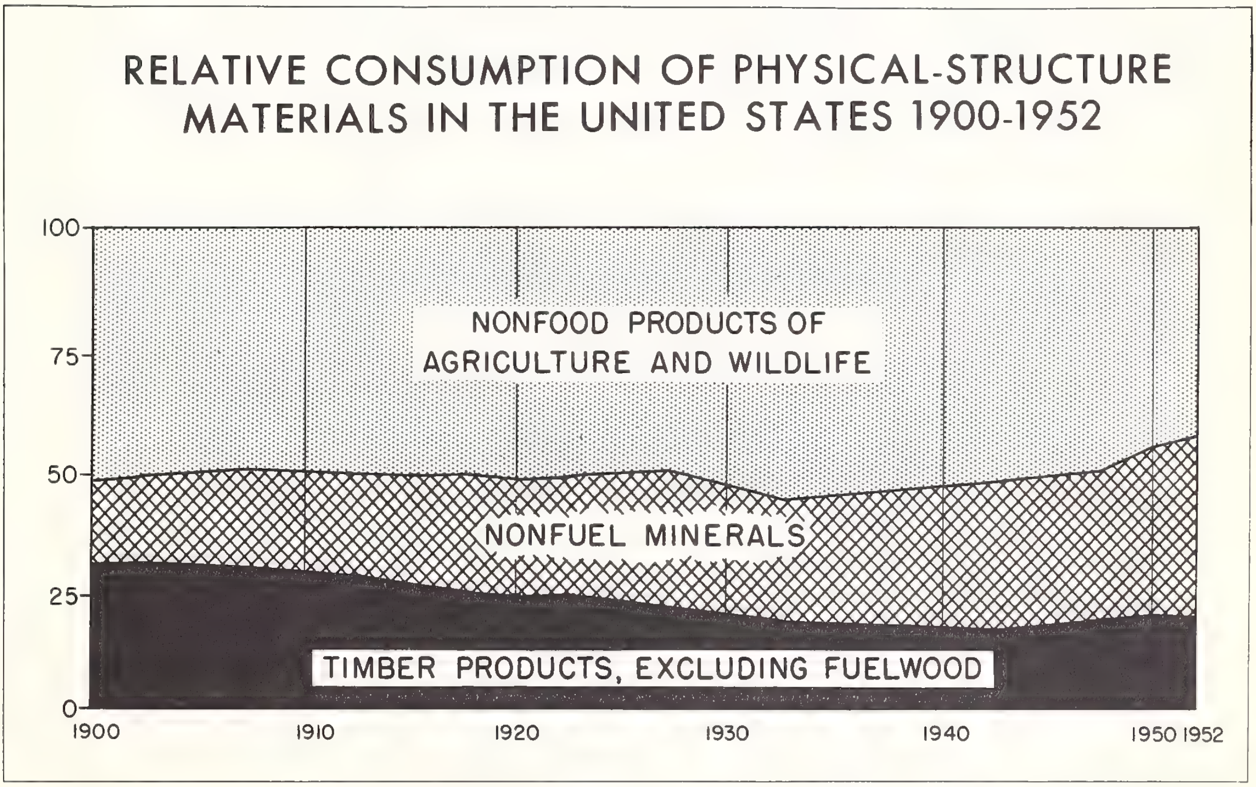


Figure 4

third of total consumption of physical-structure materials. The proportion grew steadily less for the next twenty years, from 1910 to 1930. In the 1930's and early 1940's, it diminished still further but then the trend was reversed. During 1950-52 timber comprised about 20 percent of the total physical-structure raw materials intake, which is about the same as it comprised during the period 1925-40. Thus there appears to be no current trend downward in the importance of timber products in the national economy.

OUTLOOK FOR FORESTRY

The outlook for forestry in a national setting as just described could hardly be other than favorable. There have been high prices, relatively strong demand, and no general depression. In recent years, forestry is being practiced on both private and public lands at an accelerated rate. It is increasingly recognized that growing timber is economically profitable under certain conditions, particularly where forest industries have substantial timber and financial resources.

Adjustments of a financial character favorable to forestry have recently been made, such as the 1943 timber capital gains amendment to the Internal Revenue Code and the Federal tax amortization program under which accelerated write-off of new plant investment was permissible. In 1953, national banks were authorized to make loans for terms up to ten years secured by forest tracts "which are properly managed in all respects."

In general, Federal, State, and private forestry programs are moving forward. Some more rapidly than others. Short term ups and downs have occurred, but over one or two decades the progress in forestry on nearly all fronts except on farm and other small private forest holdings has been remarkable. Private-public relations in forestry are improving as is mutual respect and confidence and a tendency to work together in greater harmony toward common objectives.

One of the assumptions for the future is that present trends in forestry will continue. Improvements in utilization have been considered in adjustment of the utilization factors converting projected requirements to projected timber cut. Full account has been taken of trends toward accelerated planting, improved protection, cultural and other forest management measures. Tangible recognition of progress in forestry was made in the projections of timber inventory and growth as subsequently explained in more detail.

UNITED STATES IN RELATION TO WORLD TIMBER RESOURCES

The purpose at this point of a brief summary of United States timber resources in relation to those of certain other countries of the world is to place the United States at the outset in its proper perspective. There are vast timber resources in other countries of North America, in other nations of the Free World, and in the Soviet Bloc of nations. A comparison of timber resources of the United States with those of other North American countries and other nations of the world affords insight as to the degree to which the United States may safely expect to rely on imports or may, on the other hand, increase its exports. The degree of self-sufficiency which the United States may need to attain is an important factor in appraising the timber situation.

INTERIOR ALASKA

Interior Alaska includes all of the Territory, except the timbered coastal strip as shown diagrammatically on the inside of the back cover of this report.[5] Although it is, of course, part of the United States, the timber resources of the Interior are not included in the various statistical summaries nor in the chapter discussions throughout the Timber Resource Review. This is because information on the timber resources of Interior Alaska is almost nonavailable, and also because these resources are largely unexploited and thus would distort the picture of the United States timber situation as it is known today. When more is known of Alaska's timber resources, and when they are subject to more active utilization, Interior Alaska doubtless will be included in subsequent timber appraisals as a region of the United States along with Coastal Alaska which is included for the first time.

Although Interior Alaska has extensive resources, they are small in relation to those of Continental United States. About 35 percent of Interior Alaska's total land area is forested. Of the 120 million acres of forest land, about 40 million acres, or 33 percent of the forested area and 12 percent of the total land area, might be classed as commercial forest land. This commercial forest land supports an estimated 32 billion cubic feet of timber, including 180 billion board feet of sawtimber, with an estimated annual net growth of about 4 billion board feet. The timber is very largely white spruce and paper birch. About 95 percent of the commercial forest land is in public ownership.

Expressed in other terms, Interior Alaska has a commercial forest area almost as large as that of Oregon and Washington. It has about one-half as much timber volume in cubic feet as the State of Washington and about 60 percent as much board-foot volume of sawtimber. Timber cut is only a fraction of one percent of current growth.

Total timber resources of Interior Alaska are substantially greater than those of Coastal Alaska. Although per acre timber volumes are much greater in the heavier stands along the coast, Interior Alaska has about ten times as much commercial forest area and about twice as much timber volume as found in Coastal Alaska, as this comparison shows:

Region	Commercial forest area (million acres)	Growing stock (billion cu. ft.)	(Live sawtimber volume (billion bd. ft.)
Interior Alaska	40	32	180
Coastal Alaska	4	18	89
Total	44	50	269

The main problems of this undeveloped resource are protection against fire, insects, and disease, and under-utilization. There is an estimated annual mortality of about two

[5] Also shown in more detail in figures 1 and 2, Chapter VIII.

billion board feet, half of which is caused by fire. The forests of Interior Alaska need better protection. They also need to be made more accessible. And, of course, there is need for greater utilization and expanded markets. They offer an additional timber supply to the United States which is not now considered to be economically available, but which ultimately may enter into normal trade channels.

CANADA

Canada is richly endowed with timber resources, especially softwoods. In relation to the United States, Canada has about 47 percent more forest land and about 8 percent more commercial forest land. As between hardwood and softwood forest types, Canada has 72 percent more softwood area but only 52 percent as much hardwood area.

In terms of total growing stock, Canada has only 80 percent as much timber volume but almost the same softwood volume. Its hardwood volume is 43 percent of that found in the United States. Timber cut from growing stock as well as net annual growth averages only about one-third of comparable volumes in the United States.

Although Canada has decidedly less sawtimber volume than continental United States, it has a much larger area of softwood timber. The United States has about twice the softwood sawtimber volume as does Canada and five times the annual sawtimber growth of all species, as shown below.

	United States (billion bd. ft.)	Canada[1] (billion bd. ft.)
Live sawtimber volume, 1953:		
Softwood	1,559	724
Hardwood	409	58
Total	1,968	782
Sawtimber growth, 1952	47	9
Sawtimber cut, 1952	49	7

[1] Canada Dept. North. Affairs and Nat. Resources, Forestry Branch. Bul. 106, Amend. Ottawa, 1954. Board-foot growth and cut estimates derived from cubic-foot statistics on basis of inventory ratio of board feet to cubic feet.

Important reasons for these differences are believed to be: (1) Forest sites on the average are less productive in Canada, a condition which is reflected both in size of trees and rate of growth, and (2) a much larger proportion of the total forested area is in uncut virgin condition and thus not contributing significantly to new growth. Total timber growth may ultimately increase 50 to 60 percent above present levels when Canadian forests are under management and when old-growth forests have been converted to more productive stands.

The forest industries contribute substantially to the domestic economy of Canada. Fifteen percent of the net value of all industrial products in Canada is attributable to the forest industries. Employment on a man-year basis totaled about 370,000 persons in 1951, with more than a billion dollars paid in salaries and wages.

Canadian forest industry is growing rapidly, but plant capacity is far behind that of the United States. For example, there are, roughly, 8,000 sawmills compared to 60,000 in the United States. There are about 2 1/2 times as many pulp and paper plants in the United States as in Canada, and over 10 times as many veneer and plywood mills.

Canadian-U. S. trade relations in forest products are important to both countries. Canada is a timber exporting nation. Of its total output, 73 percent of the veneer, 69 percent of the paper and paperboard, and 33 percent of the lumber are exported to the

United States. Canada is the principal source of United States imports of timber products. For example, about 91 percent of all lumber imported by the United States comes from Canada as does 82 percent of the woodpulp. A high proportion of our imports of other timber products likewise comes from Canada (table 2).

Table 2.--Relative importance of the timber products trade between Canada and the United States, 1952

Product	Proportion of Canadian output exported to U.S.	Proportion of U.S. imports that originate in Canada	Proportion of U.S. consumption imported from Canada
	Percent	*Percent*	*Percent*
Lumber	33	91	5
Pulpwood	15	99	10
Woodpulp	18	82	9
Paper and paperboard	69	96	17
Veneer	73	94	Negl.
Plywood	10	70	Negl.
All products	36	90-95	10

Ultimately, if Canadian forests increase present growth substantially, Canada may be able to support not only increased requirements resulting from rapid expansion of its own domestic economy, but also increased exports primarily in softwood species for pulp. In projecting U.S. domestic timber requirements, an allowance is made for a conservative increase in imports chiefly from Canada from 1.15 million cubic feet of roundwood in 1952 to 1.25 in 1975 and 1.35 in 2000. Canada might be able to support even greater exports to the United States depending on its domestic growth, export requirements of other countries, and the rate of progress of forestry in Canada. However, the outlook for increased imports from Canada of softwood lumber of quality grades is not encouraging over the long run. At present rates of cutting, there appears to be a 25 to 50 years' supply of old-growth Douglas-fir, which is perhaps the most important source of high quality lumber in Canada.

MEXICO

Mexico will not be an important factor in the United States' timber situation in the long run. Mexico has, roughly, a tenth as much forest land as the United States and a tenth as much timber. Hardwoods exceed softwoods both in forest area and timber volumes by a ratio of two-to-one in Mexico, and the cubic-foot softwood timber volume is roughly equivalent to that of Coastal Alaska. The most important commercial softwoods consist of ponderosa pine, Mexican white pine, limber pine, and sugar pine, which occur mainly on the mountains of the Sierra Madre Occidental Range, extending southward through the western half of the country from the Arizona-New Mexico border. It is estimated that timber cut somewhat exceeds net timber growth. The limited size of Mexico's timber resources and limited utilization and growth would indicate that Mexico is not a significant factor in appraising the United States' outlook.

NORTH AMERICAN RESOURCES COMPARED TO THOSE OF THE FREE WORLD

To the extent data are available or estimates can be made, the timber resources of the various countries of North America are summarized as to area, volume, growth, and cut in table 3.

Table 3.--Forest resources of North America, 1953

Country	Total land area	Forest land					
		Total forest land	Commercial			Non-commercial
			Total	Softwood	Hardwood	
	Million acres	*Million acres*	*Million acres*	*Million acres*	*Million acres*	*Million acres*
United States-------	1,903	648	484	230	254	164
Alaska[1]-------------	366	136	44	33	11	92
Canada[2]-------------	2,218	951	529	396	133	422
Mexico--------------	487	64	49	16	33	15
North America-------	4,974	1,799	1,106	675	431	693

Country	Timber volume[3]			Net annual timber growth[4]	Timber cut[4]
	All species	Softwood	Hardwood		
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*
United States------	498	337	161	14.2	10.7
Alaska[1]------------	50	41	9	1.0	([5])
Canada[2]------------	397	328	69	[6] 4.5	3.6
Mexico-------------	59	19	40	0.5	0.7
North America------	1.004	725	279	20.2	15.0

[1] Combines coastal and interior Alaska.
[2] Excludes Labrador.
[3] On commercial forest land.
[4] Of growing stock on commercial forest land.
[5] Less than 0.05 billion.
[6] Questionable estimate. Growth on areas not under exploitation is probably less than on areas now being exploited. If the stands are comparable, total growth on commercial forest land would be about 6.6 billion cubic feet. If there is no net growth on unexploited areas, the total would be about 2.7 billion cubic feet. The estimate shown is about halfway between these two extremes.

In addition to North America, the Free World includes Latin America, Free Europe, Free Asia, the Pacific area, and Africa. In comparison to total timber resources of the Free World, North America has only one-fourth of the total forested area but three-fourths of the total softwood area.

The only comparable estimates of timber volumes for the nations of the Free World or the world are for "forests under exploitation" which are limited to those forests currently yielding industrial wood or fuelwood. For the Free World, this includes only 2 billion acres of a total of 7.5 billion acres of forest land. And of these 2 billion acres, 625 million are softwoods, 64 percent of which are in North America. For all forests under exploitation, North America has about one-third of the total timber volume and 70 percent of the softwood volume. North America's share of hardwood forest resources of the Free World is small (23 percent) on forests under exploitation and would be very

much smaller if more of the hardwood timber in the other free countries, particularly in Latin America and Africa, were available.

WORLD RESOURCES

Lack of data and lack of comparability of such data as are available make it extremely difficult to compare world timber resources. Such information as is available indicates that North America includes 19 percent of the world's forest area; the rest of the Free World, 59 percent; and the Soviet Bloc of nations, 22 percent (fig. 5 and table 4). The softwood forest area of the world is fairly equally divided between the Free World and Soviet Bloc of nations. The Free World includes over 90 percent of the hardwood forest area.

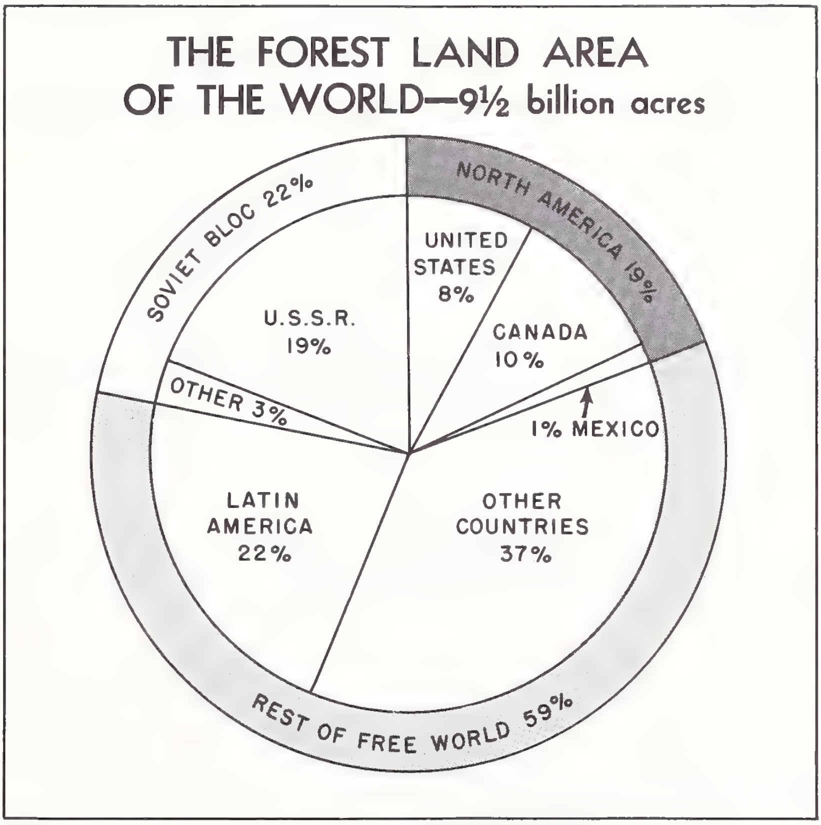


Figure 5

Only about one-third of the world's forest area is classed as under exploitation, and timber volume estimates are available only for that portion. There are no timber volume estimates for all the world's forests.

About one-fourth of the Free World's forest area is under exploitation, whereas nearly half of the forest area in the Soviet Bloc is so classified. Roughly two-thirds of the timber volume is in nations of the Free World and one-third in the Soviet Bloc. But with respect to softwoods, about three-fifths is in the Soviet Bloc and two-fifths in the Free World.

In summary, it is evident that the United States is reasonably well endowed with timber resources in relation to those of other nations of the world. It is in a favorable position with respect to softwoods, if its softwood forests are effectively managed. Proximity to Canada, the extent of Canadian resources, the Canadian potential for increased timber growth, and existing export of timber products from Canada to the United

Table 4.--Distribution of world forest resources, 1953[1]

Country or region	Forested area			Timber volume[2]		
	All types	Softwood	Hardwood	All species	Softwood	Hardwood
North America:						
United States and Alaska-------------	*Percent* 8	*Percent* 14	*Percent* 5	*Percent* 15	*Percent* 19	*Percent* 10
Canada[3]--------------	10	23	4	7	10	3
Mexico----------------	1	(4)	1	(4)	1	(4)
Total--------------	19	37	10	22	30	13
Rest of Free World-----	59	11	82	42	12	77
Soviet Bloc------------	22	52	8	36	58	10
	100	100	100	100	100	100

[1] Source: United Nations' Food and Agr. Organ. World Forest Resources. Rome, 1955. Data for North America revised to agree with statistics given in other parts of this report.
[2] Of forests under exploitation. About 31 percent of the world's forests are being exploited, 39 percent in North America, 22 percent rest of Free World, and 47 percent in Soviet Bloc.
[3] Excludes Labrador.
[4] Less than 0.5 percent.

States are all favorable factors. The United States is dependent on Canada for substantial timber imports, and Canada's timber resources appear to be such that we may continue to depend on Canada for equal or greater imports in the future.

The resources of Coastal Alaska are already actively a part of the United States' domestic timber situation and are considered an integral segment of continental United States' timber resources. There are important timber resources in Interior Alaska which, in terms of forest area and timber volumes, exceed those of Coastal Alaska or Mexico. Accessibility is the present handicap to development of Interior Alaska's forests, but ultimately they can be expected to add to the U.S. timber supply. They are not sufficiently large, however, to significantly affect the world timber picture.

North America includes the bulk of softwood resources of the Free World with the Soviet Bloc and Free World nations dividing about equally the softwood forest area. The Soviet Bloc of nations has a favorable margin with regard to softwood timber volumes on exploitable forests. Free Asia, Latin America, and Africa are responsible for the fact that the great bulk of the world's hardwood timber resources are in the Free World group of nations.

REQUIREMENTS FOR WOOD ARE INCREASING

Before reviewing present and prospective timber supplies in the United States, it is important to outline potential demand or requirements in order that the reader may have before him a clear picture of the Nation's need for wood against which may be appraised our present timber situation and prospective growth.

Consumption of timber products and timber requirements or potential demand are very nearly the same thing except with respect to time. Consumption is what has happened, whereas timber requirements are projections of what may happen in the future under certain assumed conditions. Timber consumption is of value not only as an indicator and guide to the future, but also as a matter of historical interest.

Estimates of timber consumption and timber requirements are developed and discussed in considerable detail in Chapters V and VI.

TIMBER PRODUCTS CONSUMPTION

The historical pattern of timber products consumption in the United States may be summarized in a variety of ways. Consumption by principal individual timber products for the few years that such estimates have been assembled are summarized in table 5. The long-term trend in all industrial wood (timber products other than fuelwood) consumption is shown in table 6, and the long-term trend in lumber consumption and pulpwood consumption which are the two principal timber product items, as well as per capita consumption of those items, are summarized in table 7.

Trends in Consumption

The volume of timber products consumed in 1952, expressed in terms of the cubic foot volume of logs and poles (roundwood), amounted to 12.2 billion cubic feet or 78 cubic feet per capita. Products other than fuelwood accounted for 84 percent of that total: Sawlogs 52 percent, pulpwood 22 percent, veneer logs and bolts 3 percent, and all other nonfuel products 7 percent. Fuelwood accounted for 16 percent.

Fuelwood represented a major fraction of all energy materials consumed in 1900. By 1950-52, it accounted for only a minor fraction (fig. 1, Chapter V). It seems most likely that the competitive position of wood as an energy material will continue to weaken.

Absolute consumption of timber products other than fuelwood increased moderately from 1900 to 1907, then declined rather steadily through 1921. There was a sharp upturn then for two years, followed by a moderate decline through 1929, and a drastic reduction during the depression that continued through 1932 to a low point in that year of 3.9 billion cubic feet. Gradually, from 1933 through 1942, consumption increased to a point just under the 1907 peak. There was a drop in consumption during the production difficulties during the war years, but this was followed by an upswing since 1950 in which consumption in each of the years 1950-52 was higher than the previous peak in 1907.

It is of interest that the per capita consumption of lumber has gradually dropped over the past half century from 539 board feet in 1900, with various ups and downs to about half that in 1952 (264 board feet). This is still high in relation to numerous other nations of the world. However, Canada and New Zealand consume more board feet per capita than the United States, their average being in the neighborhood of 280 board feet. Norway and Sweden consume about 210 and 150 board feet per capita, respectively; USSR, 130 board feet per capita; United Kingdom, 68; France, 42; Brazil, 25.

In contrast to the downward per capita trend in lumber consumption in the United States, both the per capita trend in pulpwood consumption as well as the absolute

Table 5.--Estimated consumption of timber products in the United States

Product	Standard unit of measure	Volume in standard units			Volume in Roundwood[1] products	
		1944	1950	1952	1952	
		Million	*Million*	*Million*	*Million cu. ft.*	*Percent*
Sawlogs (lumber, sawn ties, etc.)[2]	Bd. ft. lumber tally	34,600	40,850	41,462	6,419	52.4
Veneer logs and bolts	Bd. ft. log scale	1,533	2,730	2,467	422	3.4
Pulpwood[3]	Standard cords	21	34	35	2,697	22.0
Cooperage logs and bolts	Bd. ft. log scale	737	690	355	73	.6
Piling	Linear feet	45	32	41	28	.2
Poles	Pieces	4	7	6	88	.7
Posts (round and split)	do	275	230	306	194	1.6
Hewn ties	do	25	12	10	67	.6
Mine timbers (round)	Cubic feet	150	100	81	81	.7
Other industrial wood[4]	do	250	250	227	168	1.4
All industrial wood	Cubic feet roundwood[1]	8,257	10,145	10,237	10,237	83.6
Fuelwood	Standard cords	70	62	59	2,008	16.4
All timber products	Cubic feet roundwood[1]	11,632	12,272	12,245	12,245	100.0

[1] The roundwood (logs and bolts) volume of pulpwood, of "other industrial wood" and of fuelwood includes only that cut directly from trees. Plant residues utilized for such products are part of the roundwood volume principally of sawlogs and veneer logs and bolts.
[2] Estimates of apparent consumption based on estimated production, less exports, plus imports, and changes in lumber stocks.
[3] Includes net imports of pulpwood, also of woodpulp and finished paper expressed in terms of pulpwood.
[4] All other timber products not including fuelwood.

consumption of pulpwood has been strongly upward. Since 1920, the per capita consumption of pulpwood has increased about threefold.

Relative consumption of lumber, pulpwood, and other timber products for some purposes is of more significance than absolute consumption. By "relative consumption" is meant the consumption of timber products, or lumber, or pulpwood, as the case may be, in relation to the total quantity of physical-structure material used in the economy. It is somewhat analogous to per capita consumption in that it takes account of changes in population. In addition, relative consumption takes account of changes in standards of living. The long-term relative consumption of lumber has been downward in direct contrast to the long-term upward trend in consumption of woodpulp (fig. 6). The relative consumption of all industrial wood products combined (excluding fuelwood) shows a downward trend until about 1930 and pretty much of a stable situation since the late 1930's. It appears quite certain that timber products were being displaced in relation to other physical-structure raw materials and in rather drastic fashion from 1900 through

Table 6.--Estimated consumption of industrial wood[1] by selected years

Year	Industrial wood	Year	Industrial wood
	Billion cu. ft.		*Billion cu. ft.*
1900	8.8	1935	5.9
1905	9.1	1940	8.0
1910	9.5	1945	7.8
1915	8.5	1950	10.1
1920	8.2	1951	10.1
1925	8.8	1952	10.2
1930	6.8		

[1] This same long-term trend, including the intervening years, is shown graphically in figure 2, chapter V.

Table 7.--Consumption of lumber and pulpwood for specified years

Year	Lumber[1]		Pulpwood[2]	
	Total	Per Capita	Total	Per Capita
	Billion bd. ft.	*Bd. ft.*	*Million cords*	*Cords*
1900	41.0	539	--	--
1905	42.4	506	--	--
1910	43.4	470	--	--
1915	36.7	365	--	--
1920	34.6	325	8.1	0.08
1925	40.2	347	10.4	0.09
1930	30.0	244	12.8	0.10
1935	23.4	184	13.8	0.11
1940	34.3	260	18.0	0.14
1945	30.6	219	22.8	0.16
1950	40.9	270	33.7	0.22
1951	39.0	253	36.2	0.23
1952	41.5	264	35.4	0.23

[1] Estimates of apparent consumption based on estimated production, less exports, plus imports. Adjustments for changes in lumber stocks during period 1930-52.
[2] Includes net imports of pulpwood, also of woodpulp and finished paper expressed in terms of pulpwood.

the 1930's. Part of this was due, of course, to improvements in the timber products themselves, such as preservative treatment of ties, reduction of waste, and other improvements. In the 1940's and more recent years, it is significant that timber products appear to have held comparatively firm against the competition of other physical-structure materials.

Factors Affecting Consumption

There are three significant factors affecting timber products consumption that deserve mention: Price, transportation, and substitution.

1. Price.--There has been a long-term upward trend in the real price index of wholesale lumber (fig. 6). Comparison of this upward trend in the real price of lumber against the downward lumber-consumption index would appear to indicate that the price of lumber has evidently been one of the major factors accounting for the failure of lumber consumption to keep pace with the consumption of physical-structure materials in general. Lumber demand was apparently more sensitive to price increases prior to the 1930's than since 1940.

Comparison of similar indices of price against consumption of products from pulpwood shows a rapidly increasing consumption against a relatively stable price trend (fig. 6). Should the real price of lumber, like that of pulpwood products, be held relatively constant, there is reasonable probability that lumber consumption would more nearly parallel the general upward trend of total physical-structure materials consumption.

2. Transportation.--Apparently not less than 2 billion dollars is being spent annually for hauling timber products from places of manufacture to points of final use. That sum is believed to be considerably more than the cost of the basic raw material as it stands in

the forest. In other words, the cost of hauling timber products from place to place exceeds the cost of stumpage.

In the future, the more productive commercial forest lands may be expected to grow a larger share of timber products than they now do and closer to areas of strongest demand. Thus, in the course of time, this should allow for a substantial reduction of West to East and South to North transportation of timber products. Present trends in the shift of population from other parts of the country to the West, together with growing industrialization of the West and South, will automatically tend to increase demands for timber products in the West and in the South. The gradual attainment of a better balance between timber production and timber consumption in the major sections of the country would entail a substantial redistribution of consumer dollars spent for timber products, with a larger part going to the growers and processors and less to transportation.

3. <u>Substitution</u>. --A general appraisal of substitution trends, both favorable and adverse to timber products, shows pulpwood and wood fiber products to be in a strong competitive position. The same is true for plywood and other veneer products. There have been some substitution trends favorable to lumber, but these have been spotty.

Shifts away from the use of timber products can be seen most readily with respect to lumber. However, a large part of such displacement of lumber has been by other timber products such as plywood, paperboard, wood fiber board, and the like. Some reduction in lumber use has resulted from improvements in engineering design and from longer service life due to preservative treatments. Lumber has lost ground as an exterior covering of wood and frame houses as it has in railroad freight cars, office furniture, and farm machinery. Part of this has been due to price, part to other factors.

Setting the substitution trends favorable to timber products other than fuelwood against the adverse trends, it appears that although timber lost heavily to other materials prior to the 1930's, it has since just about held its ground against the nonwood materials (see fig. 4). This is contrary to the popular belief that timber products are consistently and currently losing ground to other physical-structure materials. In projecting potential demand, attention has been given to both favorable and unfavorable substitution trends insofar as it has been possible to do so.

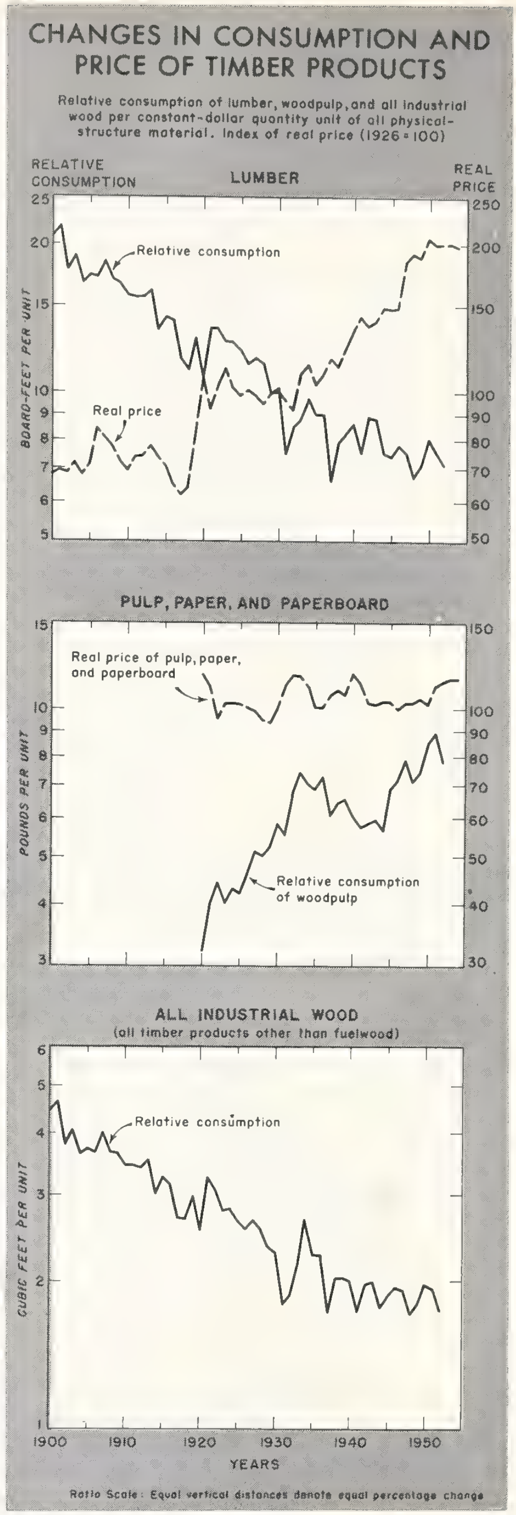


Figure 6

TIMBER REQUIREMENTS

Meaning of Requirements

Long-term timber requirements are estimates of potential demand for timber products at some specified future time under a set of assumed conditions. They are not to be regarded as forecasts of actual future consumption of timber products. They are more analogous to the potential demand estimates frequently made by large manufacturing concerns to use as guidelines for making advantageous decisions as to when and how much to change production facilities.

Attempts to look 25 to 50 years into the future, of course, entail much uncertainty about almost every factor to be considered. Nevertheless, it is impossible to escape the fact that the growing of commercial timber from seedling to merchantable tree is an enterprise that extends from 20 to 100 years or more. Forest management inevitably involves the planning of operations over long periods of time.

Much has been done in the past to alter the forward outlook for timber supply. Much more can be done to alter it still further. Policy decisions as to what should be done in this matter depend partly on the long-term potential demand for timber products.

For any enterprise as economically important as the production and utilization of timber products, supply plays some role in the generation of its own demand, and demand certainly exerts an influence upon supply. In the case of timber, however, response on the supply side cannot become very effective in one year or in ten. The apparent ease or difficulty of economically developing a supply commensurate with potential future demand provides some clue as to the future trend of timber prices. Potential demand higher than prospective supply indicates a probability of upward movement of timber price. But higher and higher real price for one of the nation's basic raw materials would not be conducive to continued improvement in the general standard of living. Nor would it be good public policy to base forestry programs for the future solely upon an estimate of potential demand that assumes a further substantial increase in the real price of timber products.

Basic Assumptions

Projections or estimates of potential future demand are necessarily based on certain fundamental assumptions. The general economic factors such as population, gross national product, civilian labor force, length of the work week, and average productivity per man hour, have already been discussed in the section "A Favorable National Setting". By way of summary, the percentage change that is estimated for three of the most basic of these factors in relation to 1952 is:

	1975	2000
Population	+34	+75
Gross National Product	+73	+229
Employed Civilian Labor Force	+28	+64

Estimated increases in population and gross national product may appear extraordinary, but the rate of increase of both of these very important economic factors is but a continuation of the rates of change which have prevailed since about 1900 (figures 1 and 2).

It is also necessary to make certain assumptions as to total and per capita consumption of all physical-structure raw materials (table 8). The estimated increases of 60 and 135 percent in total volume of physical-structure raw materials reflect increases in both

population and standards of living. The per capita increases of 14 and 28 percent for 1975 and 2000 over 1950 reflect projected increases in standard of living only.

Table 8.--Some important projections underlying the estimates of potential requirements for timber products

Item	Base		Projections	
	Year	Value	1975	2000
Index of physical structure raw materials consumption:				
Total volume-------------------------	1950	100	160	235
Volume per capita-------------------	1948-51	100	114	128
Number of households, millions-----------	1954	47	65	91
Housing inventory, million units---------	1954	51	70	98
New housing, million units per year------	1954	1.3-1.4	2.2	2.4
New nonresidential construction, billion 1953 dollars per year------------------	1954	$21	$35	$60
Maintenance and repair, billion 1953 dollars per year:				
Residential expenditures-------------	1953	$ 6.6	$ 9	$13
Nonresidential expenditures----------	1953	$ 6.6	$11	$19

These basic economic factors must be translated into such key projections as requirements for new housing, dollar volume of non-residential constructions, and dollar volume for both residential and nonresidential maintenance and repair before estimates can be made of potential demand for wood. The development of the projections on housing, nonresidential construction, and maintenance and repair are complex and are presented in detail in Chapter VI, although summarized in table 8. They show substantial increases. For example, compared to 1954 new housing is up 63 percent in 1975, 78 percent in 2000; nonresidential construction up 67 percent in 1975, 186 percent in 2000; and similar large increases for maintenance and repair.

Because these assumptions are so basic, because they are such large increases, and because they are such important determinants of potential future demand for forest products, the reader is urged to study their detailed development in Chapter VI.

Requirements for Timber Products

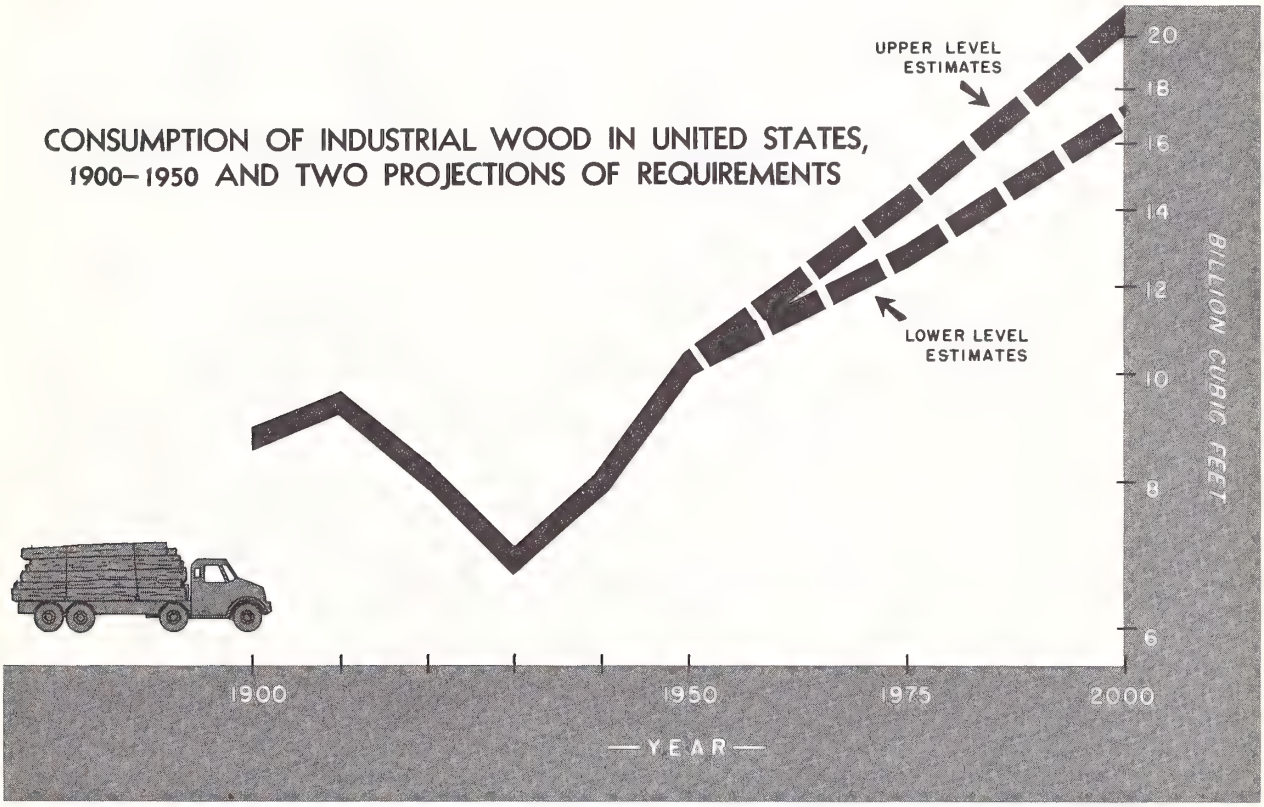
In past estimates of timber requirements, the Forest Service has estimated one set of requirements for a specified period. This time, because of the great uncertainty associated with any projection of potential demand, a range of requirements is estimated as a result of applying two methodologies under the same set of general assumptions but different with respect to future price. These result in rather substantially different estimates and are, henceforth, referred to as upper and lower level estimates.

Two Sets of Estimates Developed

The lower level estimates are derived essentially from a projection of past consumption trends product by product as influenced by the basic economic assumptions. The downward trend of relative consumption of timber products has been accompanied by a rise in the real price of timber products (fig. 6). Thus the lower level estimates reflect a relative decrease in demand for timber products and continued increase in the real price.

Upper level estimates are predicated on the assumption that industrial timber products will occupy the same position relative to consumption of all physical-structure materials as they did in 1952. In other words, the upper level estimates assume that the ratio of industrial wood consumption of 1.7 cubic feet per unit of physical-structure materials which prevailed in 1952 will also prevail in 1975 and 2000. Thus the upper level estimates assume a continuation of the status quo with respect to the role of timber products in the national economy.

The upper level estimate of potential demand reflects a continuation of the rate of increase in consumption of industrial wood that has prevailed since about 1930 (fig. 7). The large increases in potential demand in relation to 1952 under such an assumption are due to increased population and improvements in standards of living, not to an assumption that industrial timber products will capture a greater part of the total market for physical-structure materials than they now possess. The lower level estimate, on the other hand, indicates a lower rate of relative consumption than prevailed from 1930 to 1950.



RATIO SCALE: Equal vertical distances denote equal percentage scale

Figure 7

The underlying methodology for both the lower and upper level demand projections results in estimates which are believed to be conservative. One assumes a decline in the role of timber products in accord with past trends. The other assumes that timber products will maintain their present place in the economy. A third assumption and third set of estimates might have been developed based upon an assumption that industrial timber products would play an increasing role in the national consumption of physical-structure materials. This has not been done because the potential demand estimates under the upper and lower projections result in such large absolute demand for timber products in relation to supply possibilities that it seemed impractical to do so.

Estimates Exceed 1952 Consumption

Both the upper and lower level estimates of potential demand for 1975 and 2000 for industrial wood and for fuelwood are summarized in table 9 in relation to 1952 consumption.

Table 9.--Comparison of 1952 consumption and potential demand for timber products

ROUNDWOOD VOLUME

Product class	1952 consumption	Lower level demand		Upper level demand	
		1975	2000	1975	2000
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Industrial wood	10,237	12,787	17,049	14,289	21,009
Fuelwood	2,008	1,504	986	1,504	986
All products	12,245	14,291	18,035	15,793	21,995
CHANGE FROM 1952					
		Percent	*Percent*	*Percent*	*Percent*
Industrial wood	--	+ 25	+ 67	+ 40	+ 105
Fuelwood	--	- 25	- 51	- 25	- 51
All products	--	+ 17	+ 47	+ 29	+ 80
PER CAPITA					
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*
Industrial	65.2	60.9	62.0	68.0	76.4
Fuelwood	12.8	7.2	3.6	7.2	3.6
All products	78.0	68.1	65.6	75.2	80.0

The lower level estimate of industrial wood of 12.8 billion cubic feet for 1975 is 25 percent greater than 1952 consumption, but is relatively less because it would mean a decline in per capita consumption of 4.3 cubic feet. Likewise, the 2000 projection at the lower level is 67 percent above the 1952 consumption, but is accompanied by a per capita decline of 3.2 cubic feet, or 5 percent. On the other hand, the upper level estimates of 14.3 and 21.0 billion cubic feet, show increases of 40 percent and 105 percent, respectively, over 1952 consumption. In terms of per capita consumption these upper level estimates show increases of nearly 3 cubic feet for 1975 and 11 cubic feet for the year 2000. The per capita increases for the upper level estimates reflect, of course, improvements in standard of living.

It is interesting to note that under the lower level projection per capita consumption of lumber in the United States drops from 264 board feet in 1952 to 219 board feet in 1975 and to 200 board feet in 2000, or 24 percent. This is lower than consumption has been at any time since 1900, with the exception of a few years during the depression of the 1930's (table 7).

Because of the methodology applied, the upper level estimates do not permit breaking down the over-all potential demand estimates by individual products, unless the same proportions were assumed as prevailed in 1952 or some other past year. On the other hand, the lower level estimates because they are largely derived from a projection of past consumption, product by product, readily lend themselves to presentation on an individual product basis (table 10).

Table 10.--Estimated potential demand, (lower level) 1975 and 2000

Product	Standard unit of measure	1975		2000	
		Standard units[1]	Roundwood[2]	Standard units[1]	Roundwood[2]
		Million	*Million cu. ft.*	*Million*	*Million cu. ft.*
Sawlogs for lumber[3]	Bd. ft. lumber tally	46,000	7,153	55,000	8,545
Veneer logs and bolts	Bd. ft. log scale	4,500	773	6,500	1,114
Pulpwood[4]	Standard cords	56	4,150	90	6,606
Cooperage logs and bolts	Bd. ft. log scale	400	82		
Piling	Linear feet	40	27		
Poles	Pieces	5	68		
Posts, round and split	Pieces	280	178 } 711	Not allocated to product	784
Hewn ties	Pieces	3	19		
Mine timbers, round	Cubic feet	130	130		
Other industrial wood	Cubic feet	280	207		
All industrial wood[5]	--	--	12,787	--	17,049
Fuelwood	Standard cords	[6] 40	[7] 1,504	[6] 30	[7] 986
ALL TIMBER PRODUCTS	--	--	14,291	--	18,035

[1] Includes net imports and volume of products recovered from mill residues.
[2] Includes roundwood-equivalent of net imports of lumber, woodpulp and paper. Includes roundwood volume cut from dead and cull trees. Excludes volume of products recovered from mill residues. Excludes 1 billion bd. ft. of re-use lumber, 1975 and 2000.
[3] Includes sawed timbers and sawed ties.
[4] Includes pulpwood net imports and pulpwood-equivalent of net imports of woodpulp and finished paper.
[5] All timber products excluding fuelwood.
[6] For industrial as well as home use. Includes mill residues used for fuel.
[7] Includes only the volume cut directly from trees, including dead and cull trees.

The product classifications of the lower level estimates are comparable to the consumption estimates for 1952 and past years shown in table 5. As would be expected, these estimates for the major industrial wood items such as lumber, pulpwood and veneer logs and bolts, show substantial increases over 1952 consumption, whereas fuelwood consumption shows a substantial decline. The product-by-product analysis is built around estimates of demand for various end-products and end-uses of the major products. Most of the end-use estimates show increases over 1952 consumption but some of them are lower. For example, the following compares potential end-use demand for lumber in 1975 with consumption in 1952:

	1952 (million bd. ft.)	1975 (million bd. ft.)
Construction and maintenance:		
Residential	16,600	20,700
Nonresidential	7,900	9,300
Railroad	1,900	2,000
Farm service	3,000	2,500
Mining	900	1,000
Total	30,300	35,500
Manufacturing	4,200	6,000
Shipping	6,900	6,500
Total used	Not estimated	48,000
Less: re-used lumber	Not estimated	2,000
New consumption or demand	41,500	46,000

In retrospect, it is apparent that estimates of future requirements made in the past have tended to be short of actual demand at the target date (table 11). All of these past estimates have followed the product-by-product approach of projecting consumption trends. One reason for the consistent under-estimation in the past has been inadequate allowance for increased population and for the influence of an expanding national economy. These under-estimates of the past should be kept in mind when considering current Timber Resource Review estimates of potential demand. These estimates are compared on a

Table 11.--Comparison of various past estimates of industrial-wood requirement with 1950 and 1952 consumption

Name of report[1] or consumption year	Date of report	Target year of requirement estimates	Lumber	Pulpwood	Veneer logs and bolts	All industrial wood[2]
			Million bd. ft.	*Million cords*	*Million bd. ft.*	*Million cu. ft.*
Capper Report------------	1920	Indefinite future-----	31,000	--	--	--
Clapp-Boyce Report-------	1924	1950------------------	--	15	--	--
Copeland Report----------	1933	"Normal"--------------	32,000	25	920	8,687
Hale Report--------------	1935	1950------------------	--	25	--	--
Yearbook of Agriculture--	1940	Indefinite future-----	30,000	25		8,020
Reappraisal Report-------	1946	1950-1955 average-----	42,500	29	2,400	10,568
Reappraisal Report-------	1946	2000------------------	39,000	40	2,400	10,832
1950 consumption---------	--	--	40,850	34	2,730	10,145
1952---------------------	--	--	41,462	35	2,467	10,237

[1] See section on "Earlier Reviews of the Timber Situation" for complete citations.
[2] Conversion of commercial-unit volume to roundwood volume based throughout on same ratios.

product-by-product basis in table 12 with other recent estimates of potential demand for 1975 and 2000, including those of the President's Materials Policy Commission made in 1952, the Stanford Research Institute made in 1954, and the Forest Service reappraisal made in 1945. Insofar as possible, these other estimates have been adjusted to attain the maximum degree of comparability with the Timber Resource Review.

Table 12.--Various estimates of potential demand or requirements for timber products

Products	Unit of measure	Reappraisal[1]	Materials Policy Commission[2]	Stanford Research Institute[3]	Timber Resource Review lower-level		Timber Resource Review upper-level	
		2000	1975	1975	1975	2000	1975	2000
Sawlogs--------------	Billion board feet--	39.0	45.0	43.2	46.0	55.0		
Veneer logs and bolts	Billion board feet--	2.4	3.9	5.4	4.5	6.5	Not segregated	
Pulpwood-------------	Million cords-------	40.0	51.0	61.4	56.0	90.0	---	
Other industrial wood	Billion cubic feet--	1.4	0.8	0.7	0.7	0.8		
All industrial wood--	Billion cubic feet--	10.8	11.6	12.6	12.8	17.0	14.3	21.0
Fuelwood-------------	Million cords-------	50.0	40.0	[4] 26.0	40.0	30.0	40.0	30.0
All products---------	Billion cubic feet--	13.4	14.3	12.9	[5] 14.3	18.0	15.8	22.0

[1] U. S. Dept. Agr. Forest Serv. Potential Requirements for Timber Products in the U. S. Report 2 from a Reappraisal of the Forest Situation. 70 pp., illus., processed. 1946.
[2] U. S. President's Materials Policy Commission. Resources for Freedom. 5 v., illus. 1952.
[3] Stanford Research Institute. America's Demand for Wood, 1929-1975. Summary of a report to Weyerhaeuser Timber Co., 94 pp., illus. Stanford, Calif., 1954.
[4] The Stanford Research Institute estimate includes only that fuelwood cut from "living commercial timber". The comparable Timber Resource Review estimate, however, includes 0.8 billion cubic feet of fuelwood from sources other than growing stock.

With respect to industrial wood for 1975 there is little difference between the estimate of the Stanford Research Institute and that of the Timber Resource Review. There are, however, differences between the two sets of estimates with respect to the individual

products. The Timber Resource Review estimate exceeds that of the Stanford Research Institute with respect to lumber but is less with respect to veneer, logs and bolts, and pulpwood. The Timber Resource Review estimate of fuelwood cut from growing stock amounts to 5.2 percent of total requirements. The comparable estimate by the Institute is 2.9 percent. As would be expected, the upper level estimate for 1975 which assumes no increase in real price of timber products and a continuation of their present position in the raw materials mix is substantially greater than the estimate of the Stanford Research Institute which assumes a substantial increase in price. More detailed information on the differences between the two estimates may be found in Chapter VI.

Requirements in Relation to Standing Timber

The preceding estimates of requirements have been in terms of the various commercial units in which products such as lumber, piling, and pulpwood are normally expressed, or in terms of roundwood volume which is the volume of logs and bolts cut from trees and taken out for use. The roundwood volumes estimates used in the preceding discussion also include net imports of lumber, woodpulp, and finished paper expressed in terms of their equivalent roundwood volume. In other words, the estimates of requirements in terms of either commercial units or roundwood volume are expressed in the same terms as estimates of past consumption.

For both upper and lower level projections, and for both 1975 and 2000, softwoods are estimated to comprise about 70 percent of potential demand and hardwoods 30 percent. Likewise, it is estimated that about 15 percent of the potential demand at both levels and for both periods will be for materials from poletimber trees, 70 to 75 percent from sawtimber trees, and the balance from other domestic sources or imports. Although prospective changes in these factors were considered separately in the product-by-product estimates, the over-all proportions came out about the same as in 1952 consumption.

Before estimates of requirements or potential demand may be related to needed growth or inventory, they must be converted to comparable terms. To accomplish this involves deductions for imports, for the portion that may come from dead or cull trees, or from noncommercial forest land or nonforest land. Additions used to be made for logging residues or the amount of timber that is knocked down or killed in logging and left unused in the woods. This is a complex process and not properly a part of the requirements discussion. Consumption estimates for 1952 are converted to growing stock and growth terms in the discussion of growth and utilization in Chapter III. The estimates of potential demand, needed growth, and inventory are compared in the concluding section of this summary and in Chapter VII.

The results of this conversion process are given in table 13 for 1975 and 2000, where, for example, it shows that 12.4 billion cubic feet of growing stock including 56.0 billion board feet of sawtimber would need to be cut from domestic forests to satisfy requirements for timber products at the lower level in 1975. As the table shows, requirements are thus translated by softwoods and hardwoods into potential demand on both growing stock and sawtimber. The potential demand for sawtimber ranges from 56 billion board feet at the lower level in 1975 to 95 billion at the upper level in 2000.

Table 13.--Requirements for timber products and associated timber cut, 1975 and 2000

Year and species group	Lower level			Upper level		
	Require-ments	Timber cut		Require-ments	Timber cut	
		From growing stock	From sawtimber		From growing stock	From sawtimber
	Billion cu. ft.	*Billion cu. ft.*	*Billion bd. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd. ft.*
1975						
Softwood	10.0	8.4	40.9	11.1	9.6	47.6
Hardwood	4.3	4.0	15.1	4.7	4.4	17.8
Total	14.3	12.4	56.0	15.8	14.0	65.4
2000						
Softwood	12.5	10.3	49.6	15.2	13.0	68.4
Hardwood	5.5	5.4	19.4	6.8	6.7	26.7
Total	18.0	15.7	69.0	22.0	19.7	95.1

PRESENT TIMBER SITUATION AND IMPLICATIONS FOR THE FUTURE

The first part of this review of the domestic timber situation, after outlining certain necessary assumptions relating to the national economic outlook, dealt with potential future demand or requirements for timber products. It was made clear that the United States will have to rely largely on its own domestic resources for its future timber supplies. Estimates of potential demand substantially larger than current consumption were developed. This second main part deals with the currently available supply of forest land and timber. The third major part will review potential demand estimates in relation to needed and prospective growth of timber, which, in turn, is based largely on the present timber situation.

Perhaps the five most significant facts about the forests of the United States are those noted on the frontispiece. These facts are:

664 million acres of forest land
489 million acres of commercial forest land
2,057 billion board feet of sawtimber
47 billion board feet net annual growth
13 billion board feet annual mortality
49 billion board feet annual cut

The subsequent discussion shows that the United States has large and extensive timber resources. However, the United States is intermediate among nations with respect to softwood resources per capita. Whereas the United States' inventory shows about 10,000 board feet of softwoods per capita, Canada has 50,000 and the U.S.S.R. over 35,000. In contrast, France has only a little over 1,000 and the United Kingdom about 100 board feet of softwoods per capita (table 14).

Table 14.--Per capita forest land area and sawtimber inventory in selected countries

Country	Forest land	Sawtimber[1]	
		Softwood	Hardwood
	Acres per capita	*Thousand bd. ft. per capita*	*Thousand bd. ft. per capita*
Canada	66.0	50.3	4.0
U.S.S.R.	9.2	37.5	6.5
Sweden	8.0	31.7	6.3
United States	4.1	9.8	2.6
France	0.1	1.2	1.7
United Kingdom	0.1	0.1	0.2
The World	3.8	4.6	2.7

[1] In forests in use only.

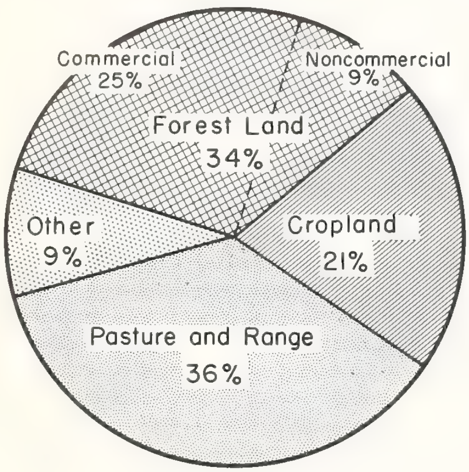
FOREST LAND

Forest land is the basic resource. The extent of forest land in relation to the total land area of the United States, the proportion of forest land that is available for commercial timber production, the location of such land geographically, its ownership, and its condition, the forest types represented, the degree to which it is stocked with growing trees and the condition of the timber are all significant facts essential to an understanding of the current timber situation and its future potentialities.

One-fourth of Nation's Land is Commercial Forest

The total forest area is considerably larger than the area devoted to crop land, but slightly smaller than the pasture and range area. However, of the 664 million acres of forest land in the continental United States and Coastal Alaska, as of January 1, 1953, 489 million acres, or about one-fourth of the total land area of the United States is classed as commercial forest land (fig. 8).

LAND AREA OF CONTINENTAL UNITED STATES AND COASTAL ALASKA BY MAJOR ECONOMIC USES



	United States	Coastal Alaska	Total
	Thousand Acres		
Forest Land	647,686	16,508	664,194
Commercial	484,340	4,269	488,609
Noncommercial	163,346	12,239	175,585
Cropland	411,148	3	411,151
Pasture and Range	693,246	91	693,337
Other	151,744	18,917	170,661
Total Land Area	1,903,824	35,519	1,939,343

Figure 8

The commercial forest lands are those which are looked to primarily for meeting timber needs. The noncommercial forest lands are those which have little or no possibilities for timber production, or have greater values for other forest uses, or are reserved from commercial timber exploitation. The 175 million acres of noncommercial forest land consists of extensive woodland types, both hardwood and coniferous, inaccessible alpine areas, forested swamps, steep mountainous slopes with sparse tree cover, or lands which would otherwise be commercially productive but are reserved from timber use. The noncommercial forest lands have important values for watershed protection, for grazing of domestic livestock, and for recreational purposes--values which frequently exceed by far commercial timber values on nearby commercial forest lands.

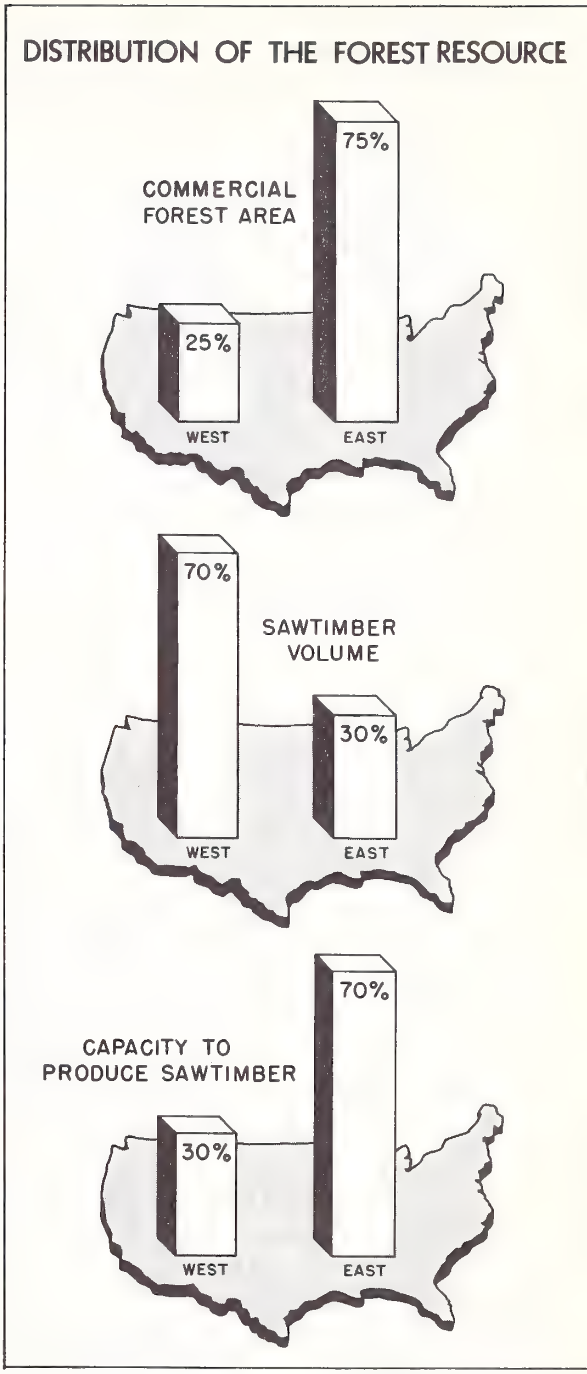
The 15 million acres of noncommercial lands which are classified as productive but reserved from timber use consists mostly of timberlands in State or national parks, wild or wilderness areas of the national forests, community watersheds, or other areas reserved from timber use. The volume of timber on such reserved areas is not known, but is obviously small in relation to total timber volume. The productive but reserved forest land is only three percent of the total commercial forest land area of the United States.

Three-fourths of Commercial Forest Land is in the East

Of the 489 million acres of commercial forest land, it is significant that three-fourths is in the East with the greatest concentrations in the Southeast, West Gulf, and

Lake States regions. Such heavily industrialized and densely populated regions as the Middle Atlantic, South Atlantic and Central regions, each have about as much commercial forest land as does the Pacific Northwest--the region with the greatest commercial forest area in the West (figures 9 and 10 and table 15). With respect to noncommercial forest land, the East-West distribution is reversed, with over three-fourths in the West and Coastal Alaska, and something less than a fourth in the East. The greatest concentrations of noncommercial forest land are in the two Rocky Mountain regions, California, and the Plains, which together have over four-fifths of the national total.

In addition to having the largest share of the commercial forest land, individual eastern regions also have the largest proportions of total land area that is classed as commercial forest. For example, New England has only 6 percent of the Nation's forest land but 76 percent of the total land area of the region is commercial forest land. In contrast, only 43 percent of the total land area in the Pacific Northwest is commercial forest land, although this is the highest percentage in the West. In four eastern regions, over half of the land area is commercial forest: 76 percent in New England, 60 percent in the South Atlantic Region, 59 percent in the Southeast, and 57 percent in the West Gulf Region.



West Includes Coastal Alaska

Figure 9

Softwood and Hardwood Types About Equal in Area

It is significant that the total commercial forest area is almost equally divided between the two major type groups, softwoods and hardwoods. This is important from the standpoint of what may be expected with respect to future growth and productivity from the lands. Furthermore, there is almost an equal area of softwood types in the East and in the West. Hardwood types, on the other hand, are concentrated almost exclusively in the East, where they exceed the area of softwood types by roughly two to one:

	Softwood types (million acres)	Hardwood types (million acres)	Total (million acres)
North	35.1	138.9	174.0
South	81.6	111.7	193.3
West and Coastal Alaska	117.4	3.9	121.3
All sections	234.1	254.5	488.6

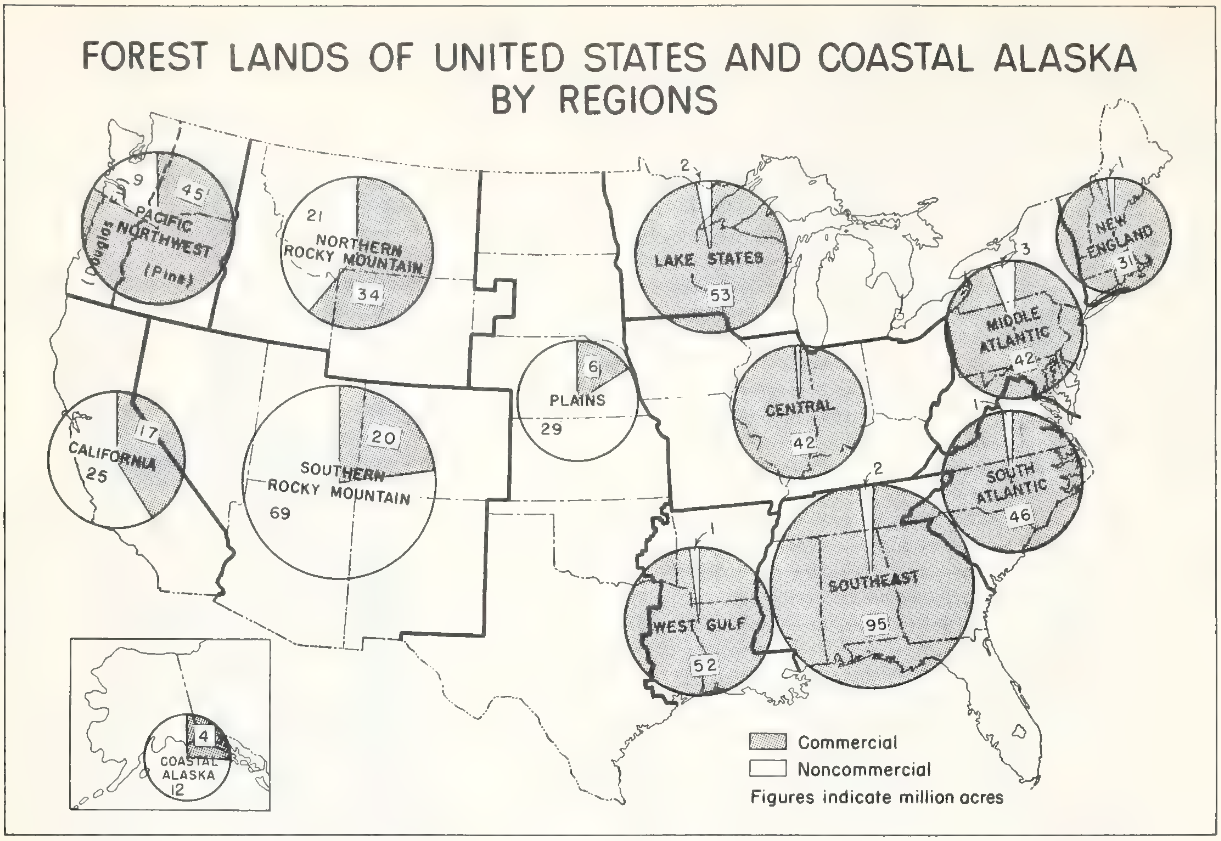


Figure 10

Three eastern types--oak-hickory, loblolly-shortleaf pine, and oak-gum-cypress--each exceed in area the most widespread western type, which is ponderosa pine (table 16). The oak-hickory type includes nearly one-fourth of the total commercial forest land area of the Nation, and is twice as extensive as the next most widespread type which is loblolly-shortleaf pine. The ponderosa pine and Douglas-fir types which are the most extensive in the West represent only 8 and 6 percent, respectively, of our total commercial forest land area. These type distributions are significant in that they foreshadow the probability that the timber inventory of the future will shift towards hardwoods as the eastern types are built up and as the old-growth conifers of the West are utilized.

Three-fourths of the Commercial Forest Area is Privately Owned

Privately owned forest lands, and mainly those in farm and "other" private (i.e., exclusive of forest industry) ownership, hold the key to the Nation's future timber supplies.[6] Nearly three-fourths of all commercial forest land is in private ownership, and over four-fifths of this, or about 60 percent of the national total, is owned by farmers and the "other" private group (fig. 11).

Public ownerships account for one-fourth of all commercial forest land with the largest concentration in the national forests. The national forests contain 17 percent (table 17).

The 23,500 forest industry owners comprise one-half of one percent of the total number of ownerships and 13 percent of the forest land. They are exceeded in impor-

[6] The significance of ownership as a factor in future timber supplies is discussed in more detail in a latter section of this summary so only the broad highlights relative to type of ownership, sectional distribution, and size class of ownership are presented here.

Table 15.--Forest land area, 1953

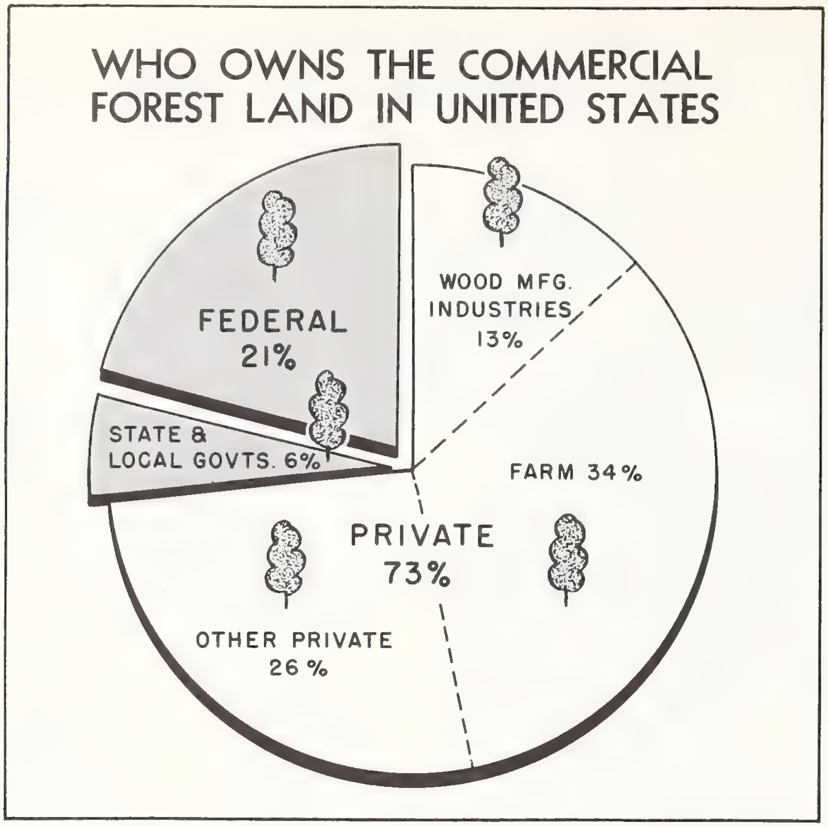
Section and region	Total forest land		Commercial forest land		Noncommercial forest land	
	Million acres	*Percent*	*Million acres*	*Percent*	*Million acres*	*Percent*
North:						
New England	31.4	5	30.6	6	.8	(1)
Middle Atlantic	44.9	7	42.2	9	2.7	2
Lake	55.2	8	53.3	11	1.9	1
Central	42.7	6	42.4	9	.3	(1)
Plains	34.6	5	5.5	1	29.1	17
Total, North	208.8	31	174.0	36	34.8	20
South:						
South Atlantic	47.3	7	46.1	9	1.2	1
Southeast	96.9	15	95.0	19	1.9	1
West Gulf	53.1	8	52.2	11	.9	(1)
Total, South	197.3	30	193.3	39	4.0	2
West:						
Pacific Northwest:						
Douglas-fir subregion	29.0	4	25.4	5	3.6	2
Pine subregion	25.1	4	20.0	4	5.1	3
Total	54.1	8	45.4	9	8.7	5
California	42.6	6	17.3	4	25.3	14
Northern Rocky Mtn.	55.3	8	33.8	7	21.5	12
Southern Rocky Mtn.	89.6	14	20.5	4	69.1	40
Total, West	241.6	36	117.0	24	124.6	71
Continental United States	647.7	97	484.3	99	163.4	93
Coastal Alaska	16.5	3	4.3	1	12.2	7
All regions	664.2	100	488.6	100	175.6	100

[1] Less than 0.5 percent.

Table 16.--Major forest type groups in the United States and Coastal Alaska, 1953

Major forest type group	Area	
	Million acres	*Percent*
Oak-hickory (E)[1]	112.2	23
Loblolly-shortleaf pine (E)	58.5	12
Oak-gum-cypress (E)	40.3	8
Ponderosa pine (W)	37.5	8
Maple-beech-birch (E)	33.4	7
Douglas-fir (W)	31.7	6
Other softwood types:		
East	58.3	12
West	48.2	10
Other hardwood types:		
East	64.6	13
West	3.9	1
All types	488.6	100

[1] Letters in parentheses identify the type group as eastern or western.



Includes Coastal Alaska

Figure 11

Table 17.--Ownership of commercial forest land, by section, 1953

Ownership	All sections	North	South	West and Coastal Alaska
	Million acres	*Million acres*	*Million acres*	*Million acres*
Private:				
Farm	165.2	61.4	90.1	13.7
Forest industries	62.4	14.1	33.5	14.8
Other	130.7	66.1	53.0	11.6
Total	358.3	141.6	176.6	40.1
Public:				
National forest	84.8	10.3	10.4	64.1
Other Federal	18.3	2.8	3.8	11.7
State and local	27.2	19.3	2.5	5.4
Total	130.3	32.4	16.7	81.2
All ownerships	488.6	174.0	193.3	121.3

tance, both as to acreage owned and number, by farm and also by "other private" ownership.

The pattern of ownership varies widely in different parts of the country. Farm ownership and other nonforest industry private ownership is concentrated in the North and in

the South. Forest industry is concentrated in the South where one-half of all forest industry ownership occurs, the balance being rather equally distributed between the North and the West. Public ownership, on the other hand, is least in the South, and greatest in the West. It is of interest too that in the West farm and "other private" ownership together greatly exceed and individually nearly equal the area owned by forest industries. In no section of the country is forest industry the predominant ownership area-wise.

The three-fourths of the commercial forest land which is in private ownership is distributed among 4.5 million owners, of whom 3.4 million, or 75 percent, are farm owners. Thus, this group is the largest single identifiable class, controlling one-third of the total commercial forest land, and making up three-fourths of the number of owners (table 18).

Table 18.--Number and area of private commercial forest land ownerships in the United States and Coastal Alaska, 1953

Ownership	Number of owners[1]	Total area	Ownership size class (acres): 50,000 and larger	5,000 to 50,000	500 to 5,000	100 to 500	Less than 100
	Thousand	*Million acres*	*Million acres*	*Million acres*	*Million acres*	*Million acres*	*Million acres*
Farm	3,382.5	165.2	.5	4.5	23.2	59.2	77.8
Forest industry:							
Lumber	21.3	34.7	18.6	10.6	3.1	1.9	.5
Pulp	.2	23.3	21.8	1.3	.2	--------	--------
Other	2.0	4.4	1.6	2.5	.1	.2	(2)
Total	23.5	62.4	42.0	14.4	3.4	2.1	.5
Other	1,104.7	130.7	15.8	15.8	19.8	36.6	42.7
Total, private area	--------	358.3	58.3	34.7	46.4	97.9	121.0
Total, number of owners (thousands)	4,510.7	--------	.3	2.5	46.3	586.5	3,875.1

[1] State basis. Owners holding commercial forest land in two or more States are counted more than once.
[2] Less than 0.1.

As would be expected with an ownership pattern predominantly controlled by farmers, the size class of ownership is predominantly small. One-third of the private commercial forest land is owned by 3.9 million individuals with less than one hundred acres each. An additional one-fourth of the land is in some 590 thousand more ownerships of 100 to 500 acres each (fig. 12). The distribution of both privately owned commercial forest land and number of private owners is as follows:

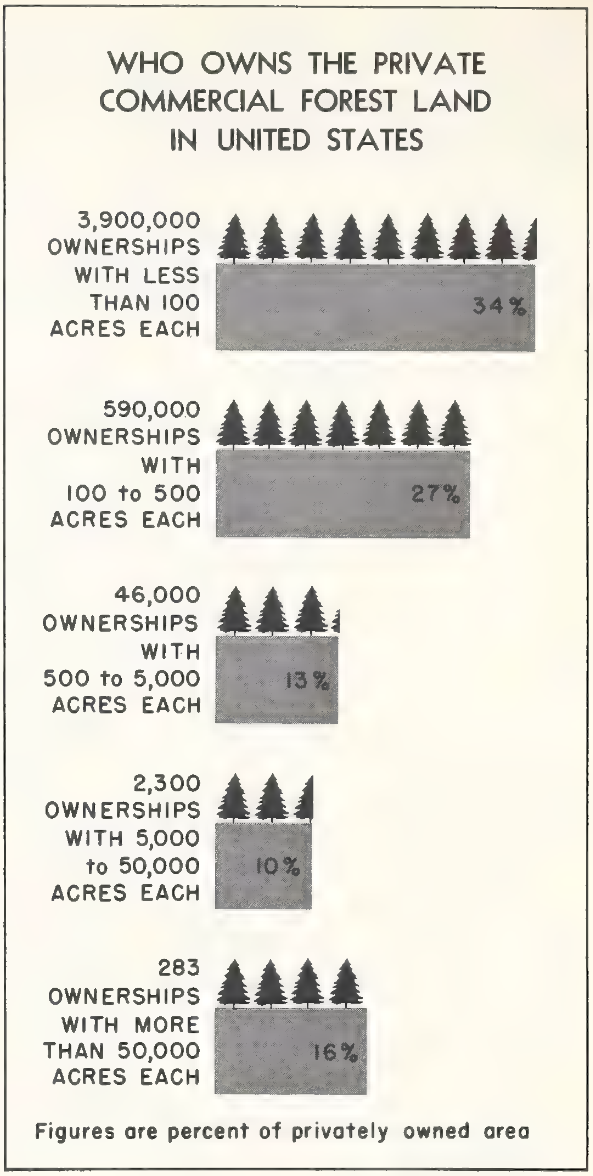
Size of ownership in acres	Percent of privately owned area	Percent of number of private owners
50,000 +	16	Negl.
5,000-50,000	10	"
500-5,000	13	1
100-500	27	13
Less than 100	34	86
Total	100	100

With farm ownerships concentrated in units of 500 acres and less, the reverse is true in forest industry ownerships where two-thirds are in ownerships of 50,000 acres and larger. Lumber industry ownership is fairly well divided among ownerships above 5,000 acres, but pulp industry ownership is concentrated in the 50,000 and larger size class. The most uniform ownership distribution according to size of holding is in the "other" private group. There the concentration tends towards the small ownerships, but there is also substantial acreage in the large and very large size classes.

Sawtimber and Poletimber Stands About Equal in Area

One criterion of forest condition and a factor in future productivity is size of timber. On a national basis the stand-size class distribution of timber is reasonably good. Something over one-third of the area is in sawtimber and slightly over one-third is in stands of poletimber trees. A little less than a third of the area is in seedlings and saplings or is nonstocked.

On a sectional basis sawtimber stands predominate in the West, mainly because of the 50 million acres of old-growth virgin stands still present, three-fifths of which is found in the national forests. Poletimber stands predominate in the North and South. The nonstocked areas of the East, about equally divided between North and South, considerably exceed the western area of either young-growth sawtimber or poletimber stands. The total nonstocked area of about 42 million acres is only a little less than the total remaining area of old-growth timber, and is presently contributing little or nothing to future timber supplies (table 19).



Includes Coastal Alaska

Figure 12

Table 19.--Stand-size classes, 1953

Stand-size class	Total		North	South	West and Coastal Alaska
	Million acres	*Percent*	*Million acres*	*Million acres*	*Million acres*
Sawtimber stands:					
Old growth	50.0	10	Negl.	Negl.	50.0
Young growth	132.7	27	47.7	60.5	24.5
Total	182.7	37	47.7	60.5	74.5
Poletimber stands	169.5	35	65.5	78.4	25.6
Seedling and sapling stands	94.8	19	44.2	38.3	12.3
Nonstocked areas	41.6	9	16.6	16.1	8.9
All classes	488.6	100	174.0	193.3	121.3

One-fourth of Commercial Forest Area is Poorly Stocked or Nonstocked

In addition to the 42 million acres of commercial forest land with less than 10 percent stocking, there are 73 million acres which are 10 to 40 percent stocked. Thus a total of 26 percent of the commercial forest lands, exclusive of old-growth stands, support less than 40 percent of full stocking (table 20). About 74 percent of the forest land is 40 percent or more stocked. Unfortunately information is not available to divide this category between good stocking (70 percent and over) and medium stocking (40 to 70 percent). Probably more than half of the lands that are 40 percent or more stocked would fall in the medium group rather than in the high-stocking category.

Table 20.--Stocking of commercial forest land, 1953

Degree of stocking	Total		North	South	West and Coastal Alaska
	Million acres	*Percent*	*Million acres*	*Million acres*	*Million acres*
40 percent or more	324.3	74	126.8	149.7	47.8
10 to 40 percent	72.7	17	30.6	27.5	14.6
Less than 10 percent	41.6	9	16.6	16.1	8.9
Total	[1] 438.6	100	174.0	193.3	[1] 71.3

[1] Excluding 50 million acres of old-growth sawtimber stands.

The younger stands have more than their proportionate share of poor stocking. Whereas 12 percent of the young-growth sawtimber area is poorly stocked, 17 percent of the poletimber area and 29 percent of the seedling and sapling stands are so classified. The 69 million acres of poorly stocked seedling and sapling stands and nonstocked areas are mainly in the Southeast and Lake States. These regions account for more than half the total. This large area, which is almost equal to the sawtimber area of the West offers one of the best possibilities for increasing timber supply (fig. 13).

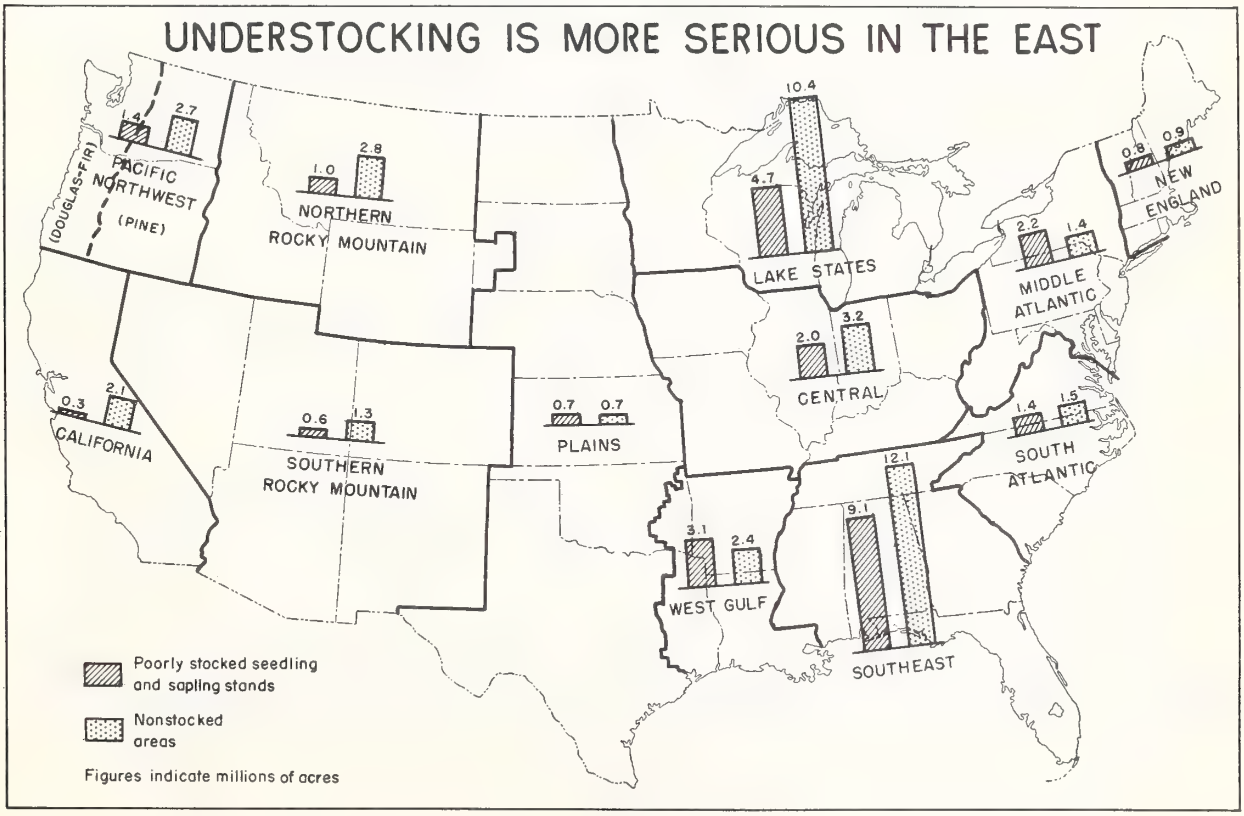


Figure 13

There is No Excess of Forest Land

Whether there is enough land available for commercial timber production is a key question and an extremely difficult one to answer. Heretofore it has generally been accepted that there was ample forest land in the United States to meet foreseeable needs if the land were adequately "put to work". Now this no longer appears clearly evident.

If the estimates of realizable growth as subsequently outlined reflect anywhere near the maximum intensity of forestry that may ultimately be expected, it appears clear that there will not be sufficiently intensive forestry applied to enough land to satisfy the upper estimate of potential demand. But, if the intensity of forestry that now prevails in some European countries, or something approaching it, were to be applied in the United States, it is believed that our forest land could ultimately supply enough timber to meet foreseeable needs. The current productivity of forest land in the United States is low in relation to the biological potential of the land. On the other hand, the biological potential is pretty much an academic concept from the standpoint of practicable attainability over large areas.

Although the trend of commercial forest land area in the United States has been consistently downward, there does not appear to have been any great change since about 1920 when the first estimate was made that compared reasonably well with present standards and concepts. The present estimate of 484 million acres in continental United States compared to the Forest Service estimate of 461 million acres made in 1945 indicates a 23 million acre increase in commercial forest land. This is believed due to two factors: (1) changes in land use, and (2) more accurate estimates. The largest addition was in the South where 10 million acres of farm land reverted to commercial forest. Substantial changes occurred in the West through reclassification of noncommercial to commercial forests, and in the North some 4 million acres of forested swamps and poor aspen sites were reclassified. On the other hand, there have been shifts in the opposite direction resulting from clearing land for reservoir sites, parks, rights-of-way, and urban uses.

It would appear, however, that in anticipation of probable increases in population, further urbanization, further development of our national highway system, and needs for agricultural land to meet food requirements, the long-term trend and pressures will be in the direction of less area for commercial forestry purposes. This probability, and the difficulties (even under anticipated progress in forestry) of meeting potential future demands for timber indicates that further significant withdrawals of commercial forest land for other uses should in general be avoided; or should be made with full realization that such withdrawals may adversely affect future timber supplies.

TIMBER VOLUMES

The quantity of timber in the United States and the extent of forest land are the two most fundamental aspects of the forest situation. Timber volumes are somewhat analogous to a storekeeper's inventory. Timber is the basic raw material from which current supplies are drawn. Because timber grows and thus is a renewable natural resource, present timber volumes have great significance for the future. They constitute the capital to which growth is added. And because of the long-time nature of forestry trees now growing will necessarily constitute the available supply for some time in the future.

Throughout the Timber Resource Review quantities of timber are discussed in two classes: (1) Sawtimber, or trees large enough to be manufactured into lumber; and (2) growing stock which includes not only the sawtimber, but also trees of smaller size which meet some commercial needs, but are generally too small to be made into lumber. More precise definitions are given in Chapter IX.

The differentiation of the sawtimber portion of the growing stock has long been followed. It is continued in the Timber Resource Review because sawtimber has been, and will continue to be, the backbone of the Nation's timber economy. From sawtimber in 1952, came 96 percent of the sawlogs cut and 56 percent of the pulpwood. More than half

of the timber cut from growing stock for fuelwood was sawtimber, and even about one-third of the fence posts. Sawtimber comprised 34 percent of the timber cut in 1952 for all products. Hence the quantity of sawtimber continues to be of prime importance.

The Timber Resource Review is the first national study to include volume of cull trees and of dead trees suitable for salvage. This was done because such material is being increasingly used for commercial purposes. The terms "live sawtimber" and "growing stock" as used in the Timber Resource Review are roughly comparable to the terms "sawtimber" and "all timber" as used by the Forest Service in its Reappraisal study in 1945. However, estimates for these categories are not comparable without adjustment of the 1945 estimate as subsequently explained.

The Nation's total inventory of timber on commercial forest land at the beginning of 1953 was 605 billion cubic feet, which included 2,094 billion board feet of sawtimber. Table 21 summarizes the basic over-all figures on timber volumes in terms of sawtimber trees, growing stock, and various other classes.

Table 21.--Timber volume in United States and Coastal Alaska, 1953

Class of material	All timber	Sawtimber[1]
Growing stock:	*Billion cu. ft.*	*Billion bd. ft.*
Live sawtimber trees--		
Sawlog portions	331	2,057
Upper stems	48	----
Total, live sawtimber	379	2,057
Live poletimber trees	138	----
Total, growing stock	517	2,057
Cull trees	56	----
Salvable dead trees	9	37
Hardwood limbs	23	----
Total, all classes	605	2,094

[1]Included in all-timber volume but also measured in board feet.

Over Two-thirds of Sawtimber Volume is in the West

About 70 percent of all the live sawtimber volume is in the West and Coastal Alaska. In terms of growing stock, the West has a smaller proportion (56 percent) of the total but still has well over half the timber volume:

	Area (percent)	Growing stock (percent)	Live sawtimber (percent)
North	36	22	13
South	40	22	17
West and Coastal Alaska	24	56	70
All sections	100	100	100

The distribution of timber volumes is significantly different than the distribution of forest area. The 70 percent of sawtimber volume in the West occurs on only 24 percent of the forest land, whereas the East with 76 percent of the forest land has only 30 percent of the sawtimber volume. The principal reasons for this are the heavy volumes of old-

growth timber on 50 million acres in the West and the generally low volumes per acre in the East.

Regional timber volumes are summarized in table 22. Three states, Oregon, Washington, and California, contain 54 percent of all sawtimber volume, and every western region with the exception of the southern Rocky Mountains contains more sawtimber volume than any eastern region. Coastal Alaska, on the other hand, often thought of as an important reservoir of softwood timber, has only about 4 percent of the total.

Table 22.--Timber volume by regions, 1953

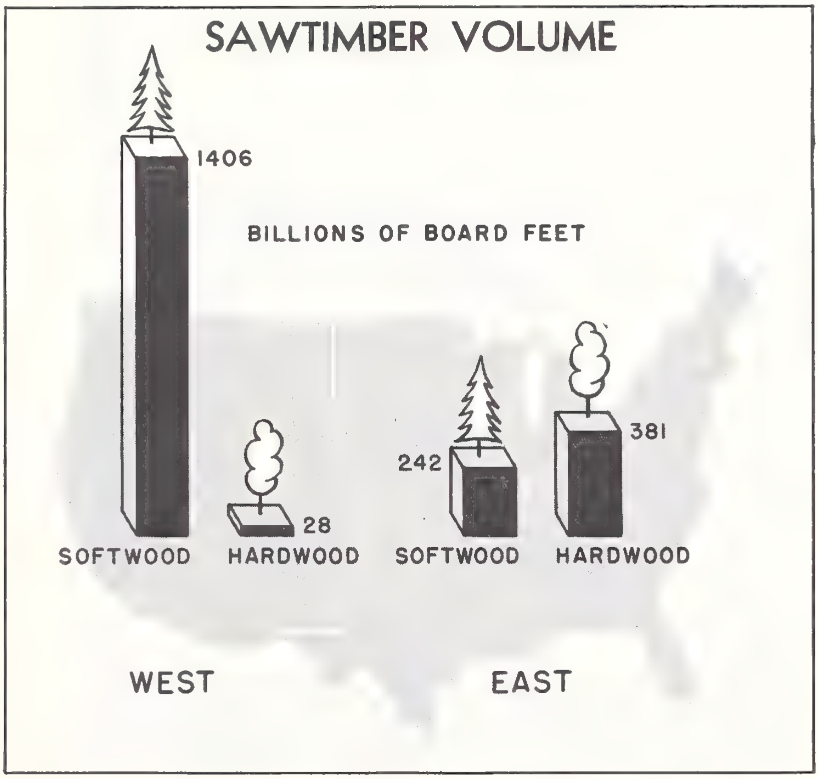
Section and region	Sawtimber[1]			Growing stock		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Billion bd. ft.	*Billion bd. ft.*	*Billion bd. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*
North:						
New England	51	27	24	24	10	14
Middle Atlantic	74	13	61	34	5	29
Lake States	50	14	36	25	7	18
Central	83	4	79	25	1	24
Plains	8	1	7	3	(3)	3
Total	266	59	207	111	23	88
South:						
South Atlantic	107	51	56	34	15	19
Southeast	139	77	62	48	23	25
West Gulf	111	55	56	32	13	19
Total	357	183	174	114	51	63
West:						
Pacific Northwest:						
Douglas-fir subregion	595	577	18	113	107	6
Pine subregion	154	154	(2)	33	33	(3)
Total	749	731	18	146	140	6
California	360	354	6	67	64	3
Northern Rocky Mountain	167	166	1	43	43	(3)
Southern Rocky Mountain	69	66	3	18	16	2
Total	1,345	1,317	28	274	263	11
Continental United States	1,968	1,559	409	499	337	162
Coastal Alaska	89	89	(2)	18	18	(3)
All regions	2,057	1,648	409	517	355	162

[1] In addition to the live sawtimber volume, there are 37 billion board feet of sawtimber in salvable dead trees; of this total 34 billion board feet are in the West, 2 billion in the North, 1 billion in the South.
[2] Less than 0.5 billion board feet.
[3] Less than 0.5 billion cubic feet.

Four-fifths of Sawtimber Volume is Softwood

Of the 2,057 billion board feet of live sawtimber 1,648 billion board feet, or 80 percent, is softwood. In terms of growing stock softwood comprises about two-thirds of the total.

About 85 percent of the softwood sawtimber volume occurs in the West, whereas 93 percent of the hardwood volume occurs in the East (fig. 14). This is true despite the fact that softwood types are as extensive in the East as in the West. It can be expected that in the future there will be a much larger proportion of the total softwood volume occurring in the East, with relatively less in the West than is now the case.



West, Includes Coastal Alaska

Figure 14

The North is greatly deficient in softwood sawtimber volume, having only 4 percent, but it has about half of the total hardwood sawtimber volume:

	Growing stock Softwood	Growing stock Hardwood	Live sawtimber Softwood	Live sawtimber Hardwood
	(percent)	(percent)	(percent)	(percent)
North	7	54	4	51
South	14	39	11	42
West and Coastal Alaska	79	7	85	7
All sections	100	100	100	100

The sectional distribution of softwood and hardwood volume in terms of growing stock is not greatly different from sawtimber distribution (fig. 15).

A comparison of softwood and hardwood volume distribution with distribution of softwood and hardwood types, both for the country as a whole and for each of the three main sections shows that softwood types on the average support heavier timber volumes

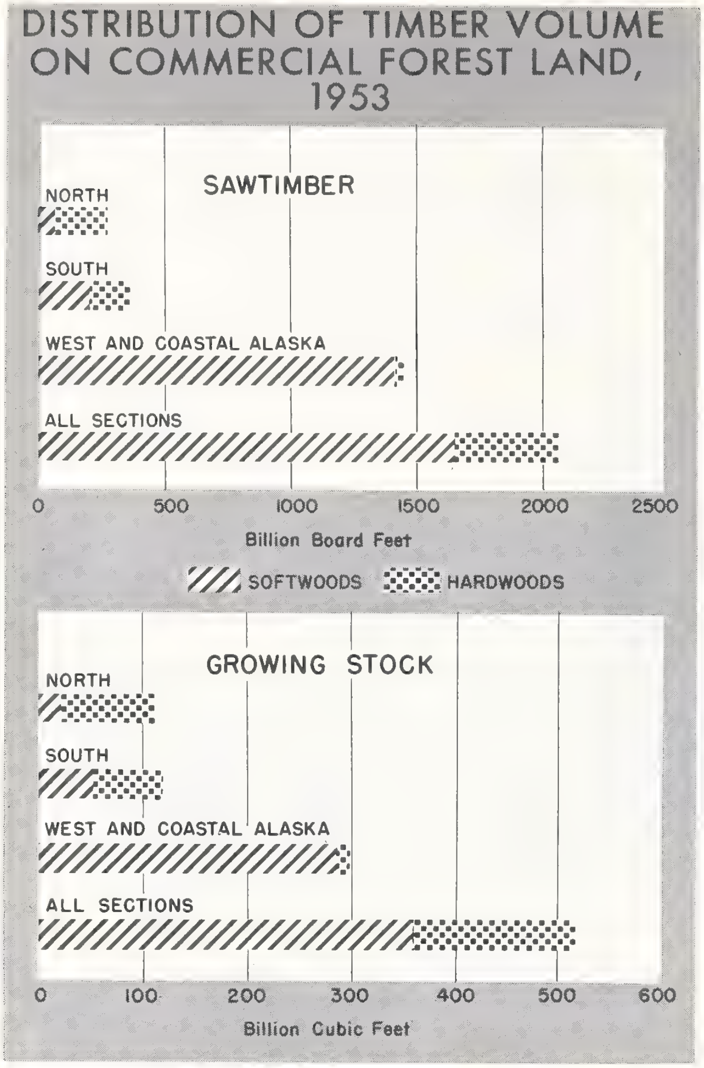


Figure 15

than do hardwood types in terms of both sawtimber and growing stock. For example, the softwood types represent 48 percent of the commercial forest area, support 80 percent of the sawtimber volume, and 69 percent of the growing stock volume (table 23).

Five Species Comprise Two-thirds of the Sawtimber Volume

Timber volumes are concentrated in a relatively few primary species, or species groups (table 24). Five such species, or groups, namely, Douglas-fir, ponderosa pine, western hemlock and Sitka spruce, western true firs, and the southern pines, account for 64 percent of total live sawtimber volume. No hardwoods are included in the first five, although the sawtimber volume of the oaks, the most important hardwood group, is almost as great as that of the southern yellow pines.

Table 23.--Distribution of forest types and timber volumes 1953

Item	All sections	North	South	West and Coastal Alaska
Commercial forest land:	*Percent*	*Percent*	*Percent*	*Percent*
Softwood type area-----	48	7	17	24
Hardwood type area-----	52	29	22	1
Total---------------	100	36	39	25
Growing stock:				
Softwood volume--------	69	5	10	54
Hardwood volume--------	31	17	12	2
Total---------------	100	22	22	56
Live sawtimber:				
Softwood volume--------	80	3	9	68
Hardwood volume--------	20	10	8	2
Total---------------	100	13	17	70

Table 24.--Timber volume by species, in the United States and Coastal Alaska

Species group	Growing stock	Live sawtimber
Eastern softwoods:	*Billion cu. ft.*	*Billion bd. ft.*
Southern yellow pine-------------------------	49	174
Other eastern softwoods---------------------	25	68
Total------------------------------------	74	242
Eastern hardwoods:		
Oak--	53	146
Sugar maple, beech, yellow birch------------	19	51
Gum--	18	51
Other eastern hardwoods---------------------	61	133
Total------------------------------------	151	381
Western softwoods:		
Douglas-fir----------------------------------	98	532
Ponderosa and Jeffrey pine------------------	43	224
Western hemlock and Sitka spruce------------	43	208
True firs------------------------------------	38	184
Sugar and western white pine----------------	10	57
Redwood--------------------------------------	6	36
Other western softwoods---------------------	43	165
Total------------------------------------	281	1,406
Western hardwoods----------------------------	11	28
All species----------------------------------	517	2,057

Growing stock volume by species or species groups is distributed differently than sawtimber volume. Douglas-fir is still first, but the oaks rank second, and the volume of southern pines is greater than the volume of ponderosa pine. Following are the five leading species or species groups in terms of percentage of sawtimber and growing stock volumes:

Species	Sawtimber (percent)
Douglas-fir	26
Ponderosa and Jeffrey pine	11
Western hemlock and Sitka spruce	10
Western true firs	9
Southern yellow pine	8
Total	64

Species	Growing stock (percent)
Douglas-fir	19
Oaks	10
Southern yellow pine	10
Ponderosa and Jeffrey pine	8
Western hemlock and Sitka spruce	8
Total	55

Sawtimber Equally Divided between Public and Private Ownerships

Slightly more than half of the total sawtimber volume is privately owned (fig. 16). About 15 percent is in farm ownership, 37 percent in forest industry and other private and 44 percent in Federal ownership. Unfortunately, unlike forest area, timber volume in forest industry ownership as distinct from other non-farm private ownership was not estimated separately.

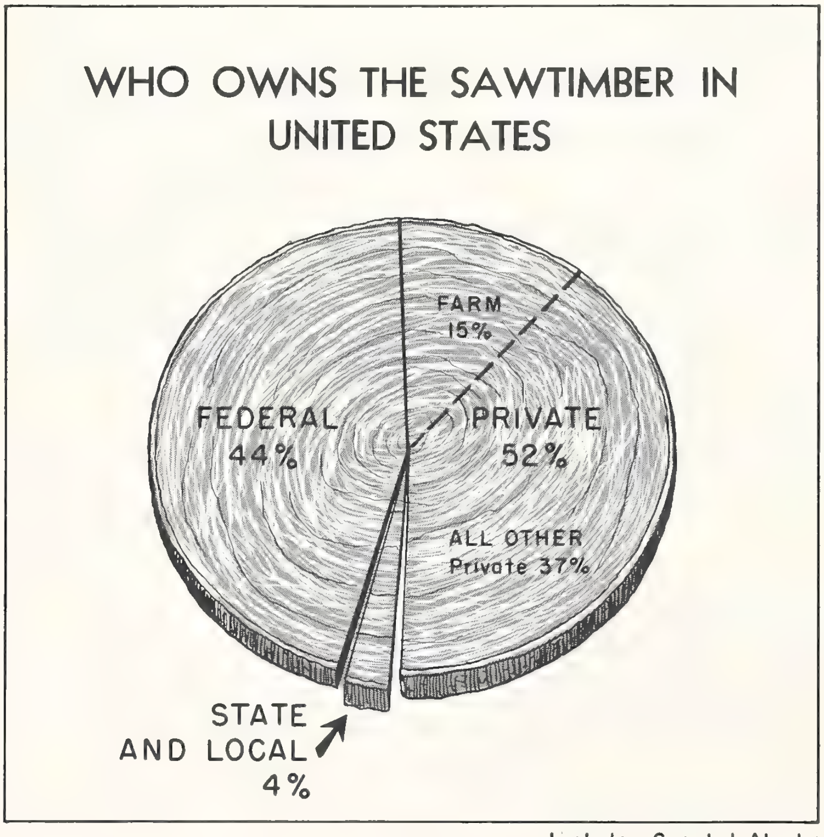


Figure 16

On a sectional basis, privately owned timber constitutes about 90 percent of the sawtimber volume in both the North and South, and is fairly equally divided between farm, and forest industry and other private ownerships. In the West, the pattern of timber ownership is distinctly different. There half the timber volume is in national-forest ownership and three-fifths is in public ownership of all types (table 25).

Table 25.--Ownership of live sawtimber, by section, 1953

Ownership	All sections	North	South	West	Coastal Alaska
	Billion bd. ft.	*Billion bd. ft.*	*Billion bd. ft.*	*Billion bd. ft.*	*Billion bd. ft.*
Private:					
Farm	308	102	144	62	--
Forest industry and other	772	132	178	462	([1])
Total	1,080	234	322	524	([1])
Public:					
National forest	766	13	23	647	83
Other Federal	135	4	8	117	6
State and local	76	15	4	57	--
Total	977	32	35	821	89
All ownerships	2,057	266	357	1,345	89

[1] Only 322,000 M bd. ft.

Ownership differs greatly between softwoods and hardwoods (table 26). The great bulk of the hardwood sawtimber volume is in private ownership and is fairly evenly distributed between farm, and forest industry and other private ownership. On the other hand, well over half of the softwood sawtimber volume is in public ownership with farm ownership relatively unimportant. The national forests and the non-farm private owners are the two principal groups controlling the softwood sawtimber volume.

Table 26.--Ownership of live sawtimber, by softwood and hardwood, 1953

Ownership class	Total	Softwood	Hardwood
	Billion bd. ft.	*Billion bd. ft.*	*Billion bd. ft.*
Private:			
Farm	308	140	168
Forest industry and other	772	579	193
Total, private	1,080	719	361
Public:			
National forest	766	740	26
Other Federal	135	127	8
State and local	76	62	14
Total, public	977	929	48
All ownerships	2,057	1,648	409

The distribution of timber volumes among ownerships is not the same as the distribution of forest land. In the West, for example, non-farm private ownerships control 22 percent of the commercial forest area, but 32 percent of the sawtimber volume. This means that this class of ownership in the West holds the preferred timbered areas--those with the heaviest stands per acre. National forests, on the other hand, include 53 percent of the forest area in the West and 51 percent of the timber volume. Thus, national-forest timberlands are about average for the West.

For the country as a whole, national forests control 17 percent of the commercial forest area and, due to the old-growth timber stands on Western national forests, they contain 37 percent of existing sawtimber volume. Farm ownerships on the other hand, contain 34 percent of the area but only 15 percent of the volume; and forest industry and other private 39 percent of the area, and 37 percent of the volume. Timber in farm ownership, therefore, is indicated as being poorer than average for the country as a whole, and is likewise poorer than average in the South (table 27).

Table 27.—Distribution of ownership of commercial forest area and of live sawtimber volume, 1953

Ownership	All sections		North		South		West and Coastal Alaska	
	Area	Volume	Area	Volume	Area	Volume	Area	Volume
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Private:								
Farm	34	15	35	38	46	40	11	5
Forest industry and other	39	37	46	50	45	50	22	32
Total	73	52	81	88	91	90	33	37
Public:								
National forest	17	37	6	5	6	7	53	51
Other Federal	4	7	2	1	2	2	10	8
State and local	6	4	11	6	1	1	4	4
Total	27	48	19	12	9	10	67	63
All ownerships	100	100	100	100	100	100	100	100

Timber Quality Outlook is Not Favorable

The need for high-quality timber is difficult to appraise. The higher grades of lumber and other quality products command premium prices. As quality timber in terms of large-size, slow-growing, and knot-free logs has become scarcer, there have been important developments in technology which have offset in part the need for such high-quality material. There are numerous ways to overcome defects in the manufacturing process, and these should not be minimized in appraising the future need for quality. Some are convinced that quality is no longer a factor to be considered with respect to timber supplies, and that national needs will be adequately met merely by growing sufficient cellulose irrespective of size, species, condition, or growth rate of the individual tree. The Forest Service does not subscribe to this view. It believes that the only safe policy for the next several decades is to continue to grow substantial amounts of high-quality timber, although it recognizes that quality is not as essential as formerly. With proper cultural measures, quality timber may be obtained from smaller and younger trees than prevailed in the old-growth virgin forests which are now approaching their end.

There are many criteria of quality. The sawtimber-growing stock distinction already mentioned is one crude measure. Log grades, the prevalence of cull trees, tree size, and species are all indicators of quality. There is relatively little nationwide quantitative information on quality, but there are numerous spot indicators which in the aggregate point conclusively to the decline in quality of timber stands.

Nearly 10 percent of the sound timber volume in the United States is in cull trees. The proportion is even higher in hardwoods. Although some of the cull trees are being used for pulpwood in the East, their suitability for sawlogs is extremely limited. Moreover they are utilizing valuable growing space and represent one of the reasons why so much of the forest land does not rate higher stocking. Cull is particularly important as a factor in the poor quality of the hardwood stands of the East. This is emphasized by the fact that cull hardwood trees are equivalent in volume to one-fourth of the entire hardwood-growing stock. In the South, the ratio is one-third, and in the southeastern region the sound volume in cull trees is equal to 42 percent of the volume of the hardwood growing stock.

Log grades are also a reflection of quality. Studies based on three-fourths of the total hardwood sawtimber volume in the East show that two-thirds of the sawtimber volume when inventoried by log grades would qualify only as the relatively poor Grade 3 logs, whereas 20 percent would fall in the Grade 2 medium category, and only 13 percent in the good Grade 1 category. The quality of hardwood stands is shown diagrammatically in figure 17, which combines log grade information and volume of hardwoods in cull trees. There is no question but that low-quality wood predominates in hardwood stands.

Low quality of wood predominates in hardwood stands

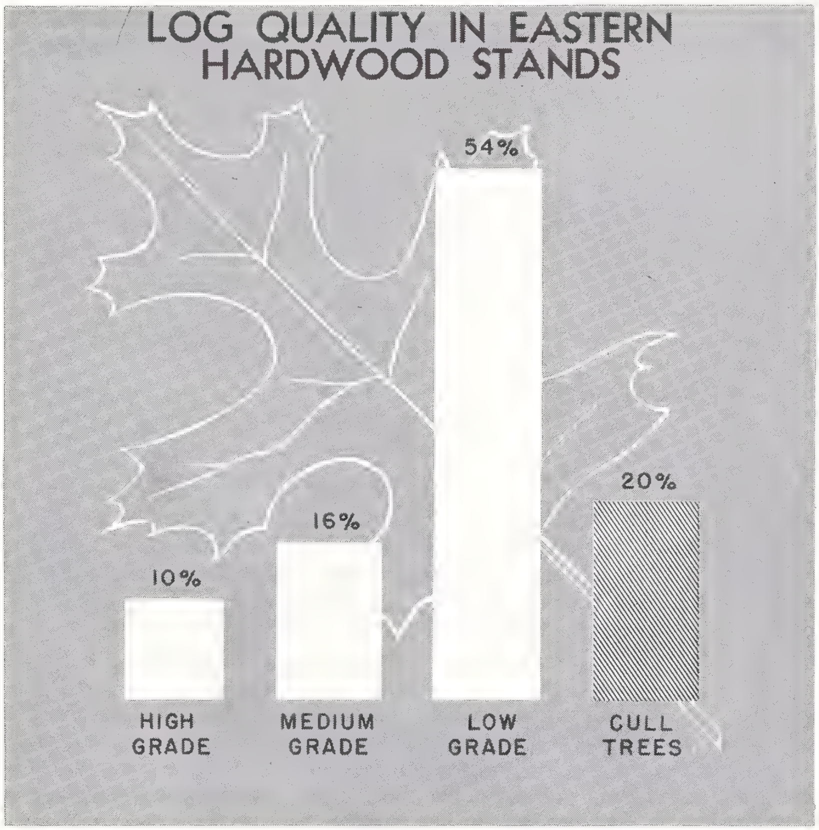


Figure 17

Tree size, likewise, reflects quality. Generally added growth means better quality until over-maturity and decay set in. Small trees have few high-quality logs. As yet tree size does not appear to be a major factor in the West because of the concentration of volume in old-growth stands. This is apparent, from the distribution of sawtimber volume by species and diameter class groupings shown in table 28. In the East, however, two-thirds of all softwood sawtimber volume is in trees of 15 inches and less, and one-fourth of the volume is in the smallest (10-inch) diameter class.

Table 28.--Distribution of sawtimber volume by tree-diameter class, 1953

WEST

Tree-diameter class (inches)	All western softwoods	Douglas-fir	Ponderosa and Jeffrey pines	Sugar and western white pine
	Percent	*Percent*	*Percent*	*Percent*
12 to 22---------	23	18	20	21
22 to 32---------	27	23	36	20
32 and larger----	50	59	44	59
All classes----	100	100	100	100

EAST

Tree diameter class (inches)	All eastern species	Softwood	Hardwood
	Percent	*Percent*	*Percent*
10-------------------------	9	24	--
12 and 14------------------	42	43	42
16 and 18------------------	27	21	30
20 and larger--------------	22	12	28
All classes--------------	100	100	100

In a few places trends in tree size are evident between timber inventories. For example, between 1935 and 1948 softwood trees in Mississippi 20 inches and larger decreased 42 percent in number. In the South Atlantic region between 1930 and 1953 surveys, the percentage of softwood sawtimber trees 20 inches and larger, declined from 17 to 14 percent, and hardwood trees in the same size class from 47 to 34 percent.

The better quality species appear to be diminishing. In the South the longleaf-slash pine type is losing ground to the loblolly-shortleaf pine type, which, in turn, is being replaced in some places by aggressive hardwood types. The once extensive white pine type of the Lake States has been reduced to about a million acres, and has been replaced by an aspen-birch type. Hardwoods tend to supplant softwoods in the spruce-fir stands in the Northeast. In the West other conifers are not uncommonly superseding the more valuable white pine, Douglas-fir and ponderosa pine.

In the aggregate, these indicators show that timber quality is on the downgrade. Despite technological advances which offset in part the need for quality, it is believed that quality will become more, instead of less, of a problem during the next several decades.

Timber Volume Trends

Broad generalizations comparing 1953 estimates of total timber volume in either growing stock or sawtimber with previous estimates of national totals can only be misleading. Such comparisons, to be valid, need to take account of differences in survey standards and as a minimum need to segregate softwoods from hardwoods, and eastern species from western species.

Comparisons of past published estimates in board feet or cubic feet with the estimates in the Timber Resource Review are not valid, as explained in Chapter II. There are numerous and complex reasons for lack of comparability such as changing utilization standards, changing diameter limits, changing definitions of forest land, changing criteria as to commercial species, and changing standards for defect. Likewise, there have been improvements in techniques which contribute to lack of comparability.

However, because such comparisons will inevitably be made, and because they are naturally a matter of considerable interest, an effort has been made to adjust earlier surveys to Timber Resource Review standards. The revised figures representing the best possible adjustment of the earlier survey estimates appear in table 29. These adjusted estimates show an increase in growing stock from 1945 to 1953 of 8 billion cubic feet and a decrease of 38 billion board feet of sawtimber. But these generalizations in themselves have little significance.

Table 29.--Estimates of timber volume in the United States,[1] 1930-53

Year	As published[2]		As adjusted for comparability	
	Growing stock	Sawtimber	Growing stock	Sawtimber
	Billion cu. ft.	*Billion bd. ft.*	*Billion cu. ft.*	*Billion bd. ft.*
1930	487	1,668	527	2,171
1938	519	1,764	508	2,096
1945	470	1,601	490	2,006
1954	498	1,968	498	1,968

[1] Excluding Coastal Alaska.
[2] Sources: 1930--U.S. Dept. Agr. Forest Serv. A National Plan for American Forestry. 1933; 1938--Cong. U.S., Joint Committee on Forestry. Forest Lands of the U.S. 1941; 1945--U.S. Dept. Agr. Forest Serv. Gauging the Timber Resources of the U.S. 1946.

In an effort to better interpret the trends, the original Forest Service estimates for 1945 have been adjusted in additional detail, and are compared to the Timber Resource Review estimates in terms of both growing stock and live sawtimber, and in terms of eastern softwoods, eastern hardwoods, and western species, in table 30. It is apparent that there has been about a 5 percent decrease in both sawtimber volume and growing stock volume of western species, almost exclusively softwoods. This, however, is to be expected, and is not an undesirable trend. It is due to the fact that the old-growth overmature forests of the West are being harvested, and growth to replace utilized inventory cannot be expected on such lands until they are cut and regenerated to more thrifty forests.

Perhaps most significant is a 2 percent decrease in softwood sawtimber volume in the East, and a 9 percent increase in hardwood sawtimber volume. The softwood decrease is an undesirable trend. Softwood sawtimber should be increasing in the East. Although an increase in hardwood sawtimber volume is not an adverse trend, it is unfortunate that some of it is replacing the more desirable softwood. The much greater increase in Eastern hardwood growing stock volume relative to sawtimber volume shows that the small-size hardwood trees are increasing at a faster rate than are the sawtimber trees.

Table 30.--Comparison of timber volume in the United States,[1] 1945 and 1953

Species groups	Growing stock			Live sawtimber		
	1945[2]	1953	Difference	1945[2]	1953	Difference
	Billion cu. ft.	*Billion cu. ft.*	*Percent*	*Billion bd. ft.*	*Billion bd. ft.*	*Percent*
Eastern softwoods-------	74	74	0	247	242	-2
Eastern hardwoods-------	129	151	+17	351	381	+9
Western species---------	287	273	-5	1,408	1,345	-5
All species-------------	490	498	+2	2,006	1,968	-2

[1] Excluding Coastal Alaska.
[2] Adjusted to 1953 basis.

Supplementary Sources of Timber Volumes Are Not Significant in Foreseeable Future

Past appraisals of the timber situation, as in the Timber Resource Review, have been limited largely to consideration of live sawtimber volumes and growing stock on commercial forest land. Such estimates constitute the basic timber inventory, which is the source of timber growth, and to which the United States must look for the great bulk of its timber supplies.

As previously mentioned, national estimates have been made for the first time of the volume of cull trees, and salvable dead trees. In addition, a rough estimate has been made of wood volumes in the pinyon pine-juniper and hardwood types on noncommercial forest lands of the West; and of timber volumes in Interior Alaska. All these estimates have been brought together in table 31. It is apparent that the growing-stock volume from the various supplementary sources if completely available would equal at least one-third of the growing stock volume on commercial forest land. But the additional sawtimber volume, which could come only from Interior Alaska and from salvable dead trees, would add only 10 percent to the sawtimber inventory on commercial land.

Both growing stock and sawtimber volumes also occur on areas reserved from timber use and on nonforest areas in narrow roadside strips, fence rows, small woodland plots too small to be included in the standard inventory, and in urbanized areas. Volumes on these areas have not been estimated.

Although the supplementary sources of timber enumerated in table 31 should not be overlooked, they are not particularly significant with respect to sawtimber. Moreover, with the possible exception of volumes in cull trees, dead trees, and hardwood limbs, it is most unlikely that they will enter into available timber supplies in the foreseeable future. Only under conditions of extraordinary national emergency, important changes in State and national conservation policies, or a major change in the economic availability of Alaska, would timber from these various supplementary sources become available.

It may be more practical to stretch existing timber supplies through utilization of amounts now lost as logging residues or unused plant residues, through reduction of mortality, through the further reduction of fuelwood consumption and the utilization of

Table 31.--Timber supply sources currently or potentially available to the United States, 1953

Source	Estimated volume	
	Billion cu. ft.	*Billion bd. ft.*
United States and Coastal Alaska:		
a. Commercial forest land--		
Growing stock and live sawtimber	517	2,057
Cull trees	56	--
Salvable dead trees	9	37
Hardwood limbs	23	--
Saplings and noncommercial species	Unknown	--
b. Noncommercial forest land--		
Reserved for special uses, including State and national parks, wild and wilderness areas, and community watersheds	Unknown but substantial	Unknown but substantial
Unreserved--		
Pinyon pine-juniper and hardwoods types in the West	34	Negl.
Other unreserved forest classed as unproductive or inaccessible for timber use	Unknown	Unknown
c. Nonforest land, including tree-covered land in suburban and metropolitan areas, city parks, shelterbelts, fence rows, scattered timbered plots less than 10 acres in West and 3 acres in East, and narrow wooded strips along streams and highways	Unknown but substantial	Unknown but substantial
Interior Alaska	32	180
Other United States possessions	Negl.	Negl.

wood now used for that purpose in other ways, and through greater reliance on imports from Canada. Volumes attributable to these items in 1952 are as follows:

Item	Growing Stock (Billion cu. ft.)	Sawtimber (Billion bd. ft.)
Logging residues	1.4	2.7
Unused plant residues	1.4	--
Mortality less salvage	2.7	9.6
Fuelwood consumption	1.0	2.2

These are simply indicators of the amounts of timber that annually are directed into these channels. To the extent that such amounts can be utilized or find their way into other channels of consumption the national wood supply would be augmented.

TIMBER GROWTH AND UTILIZATION

In addition to information on forest land areas and amounts of standing timber, there are two other key characteristics of the forest situation, an understanding of which is essential not only with respect to present day conditions, but also because of their implications for the future. These are the rates at which forests are growing and are being utilized. Growth is especially significant in that this characteristic of continuous replacement differentiates timber from other physical structure raw material resources which are nonrenewable.

In appraising timber growth, and timber utilization or cut, care should be taken not to over-emphasize or misuse broadly generalized growth-cut balances. There is a popular tendency to believe that if over-all national comparisons indicate that growth exceeds cut, the forest situation is favorable, and if cut exceeds growth the reverse is true. Neither conclusion is justified. Significant comparisons of growth and cut are the relationships by species, or by softwoods and hardwoods, or by certain regions. Even here care must be taken not to confuse growth-cut ratios based on old-growth timber with those for second growth, or ratios for growing stock with those for sawtimber, nor to overlook the level at which the balance or unbalance may occur. Uninformed use of growth-cut relationships often demonstrates the aptness of the phrase that a "little knowledge is a dangerous thing."

Growth Is Increasing

Timber growth as used in the Timber Resource Review is net growth which means growth after deductions for mortality. In this respect it differs from the growth estimates in the 1945 Reappraisal report of the Forest Service which used gross growth or growth before deductions were made for mortality. The 1944 estimates are also not directly comparable because of changing inventory standards over the years. For this and other reasons the 1944 estimates have been adjusted in the subsequent discussion to permit valid comparisons with 1952. Annual growth includes the growth of timber on hand at the beginning of the year plus the total volume of young timber that becomes measurable during the year (commonly referred to as "ingrowth").

As in the Reappraisal, growth estimates apply to the year preceding the date of inventory. The inventory estimates were made as of January 1, 1953 but they are referred to as "1953" estimates. The growth period is the calendar year 1952.

Growth up 9 percent since 1944

It is significant and reassuring that sawtimber growth in 1952 was 9 percent greater than the adjusted 1944 level (table 32 and fig. 18). The change is even more significant in the second growth of the East. Here softwood and hardwood sawtimber growth increased 12 and 15 percent respectively over 1944. The percentage increases in growing stock growth were somewhat more pronounced.

Table 32.--Comparison of timber growth in the United States, 1944 and 1952

Species group	Growing stock			Live sawtimber		
	1944[1]	1952	Difference	1944[1]	1952	Difference
	Billion cu. ft.	*Billion cu. ft.*	*Percent of 1944*	*Billion bd. ft.*	*Billion bd. ft.*	*Percent of 1944*
Eastern softwoods	3.8	4.4	+16	15.2	17.0	+12
Eastern hardwoods	5.9	7.1	+20	16.6	19.1	+15
Western species	2.8	2.7	-4	11.6	11.2	-3
All species	12.5	14.2	+14	43.4	47.3	+9

[1] Adjusted to 1952 basis.

In the West sawtimber growth decreased 3 percent between 1944 and 1952 and growing stock growth showed a 4 percent decline. As old-growth areas in the West are cut and second-growth stands reach measurable size western growth should substantially increase. Considering the large areas of second growth in the West it would be expected that western growth would be greater in 1952 than in 1944. A probable explanation of the decrease is unusually high mortality due to bark beetle attacks in the Northern Rockies, and accelerated cutting of second-growth timber.

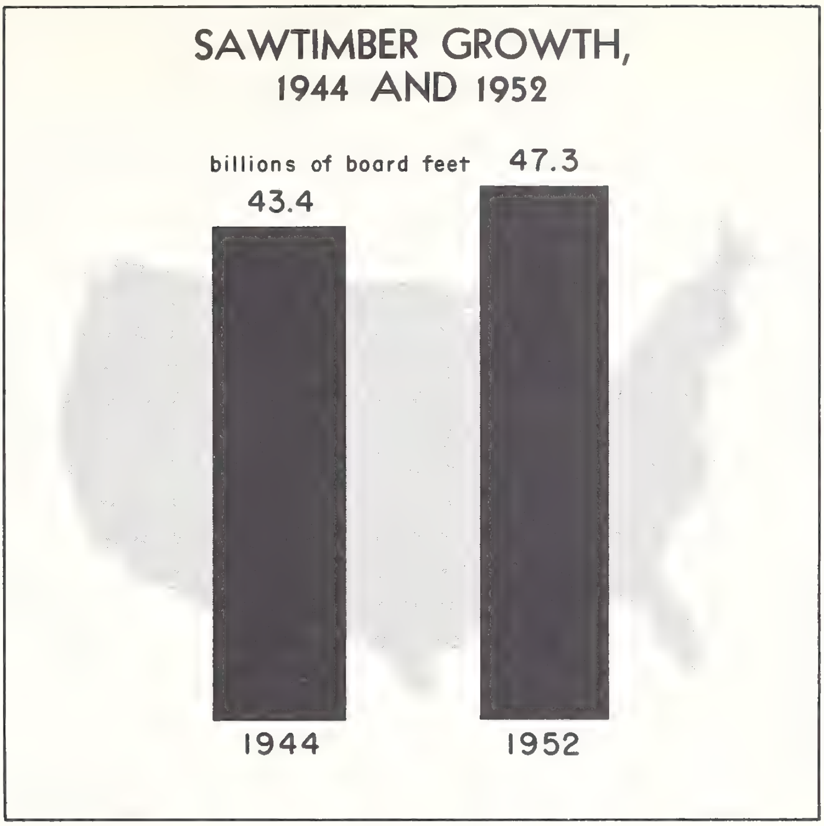


Figure 18

One-half of the Nation's timber growth is in the South

The South leads the Nation in growth of both sawtimber and growing stock. Likewise, it leads both West and North in softwood growth and lags only slightly behind the North in growth of hardwoods. Of the national total of 47.4 billion board feet of sawtimber growth in 1952, 51 percent occurred in the South. Over 20 percent occurred in the Southeast region alone--almost equal to the sawtimber growth in the entire West (table 33). In terms of growing stock, with a national total of 14.2 billion cubic feet, the South grew 48 percent or 6.8 billion. Growth in the West continues to be held down by the large residual of old-growth timber which has little net growth.

Sixty percent of all sawtimber growth in the South is softwoods, as well as half of all growing stock growth. Only in the North do hardwoods dominate the growth picture and there nearly four-fifths of the sawtimber growth is in hardwoods.

Mortality of timber by causative agents, importance, and geographical occurrence is subsequently discussed in the section on "Protection Against Destructive Agencies." Total mortality (without reference to amounts salvaged) is shown in table 33 where it is apparent that mortality averages about 25 percent of growth of both sawtimber and growing stock, and is substantially higher in softwoods than in hardwoods. If mortality could be substantially reduced, it would be one of the most effective measures to extend the available supply of timber.

One-third of sawtimber growth is southern yellow pine

The growth of southern yellow pines as a group in 1952 was 14.2 billion board feet, or about 30 percent of total sawtimber growth (table 34). The growth of southern pines so

Table 33.—Net annual growth of timber on commercial forest land by regions, 1952

Section and region	Growing stock			Live sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd. ft.*	*Billion bd. ft.*	*Billion bd. ft.*
North:						
New England	.88	.29	.59	1.86	.91	.95
Middle Atlantic	1.35	.15	1.20	3.16	.47	2.69
Lake States	1.18	.32	.86	2.69	.80	1.89
Central	1.13	.05	1.08	3.96	.25	3.71
Plains	.12	.01	.11	.40	.04	.36
Total, North	4.66	.82	3.84	12.07	2.47	9.60
South:						
South Atlantic	1.91	.97	.94	6.88	3.67	3.21
Southeast	3.06	1.72	1.34	10.04	6.68	3.36
West Gulf	1.84	.88	.96	7.10	4.15	2.95
Total, South	6.81	3.57	3.24	24.02	14.50	9.52
West:						
Pacific Northwest:						
Douglas-fir subregion	1.00	.94	.06	5.15	5.01	.14
Pine subregion	.33	.33	([1])	.83	.82	.01
Total	1.33	1.27	.06	5.98	5.83	.15
California	.59	.54	.05	2.94	2.89	.05
Northern Rocky Mtn.	.60	.59	.01	1.53	1.51	.02
Southern Rocky Mtn.	.22	.91	.03	.73	.68	.05
Total, West	2.74	2.59	.15	11.18	10.91	.27
Continental U. S.	14.21	6.98	7.23	47.27	27.88	19.39
Coastal Alaska	.03	.03	([1])	.13	.13	([1])
All regions	14.24	7.01	7.23	47.40	28.01	19.39
Mortality, All regions	3.49	2.24	1.25	12.52	10.09	2.43
Mortality as percent of growth	25	32	17	26	36	13

[1] Less than 0.005
[2] These estimates represent the current level of mortality indicated by trends over a period of years, as determined in 1952. The estimates of mortality in 1952 shown subsequently in the protection discussion in this Chapter are the same except in the West. The 1952 mortality in the West is higher by .02 billion cubic feet of growing stock and .15 billion board feet of sawtimber than used in these periodic estimates due to abnormally high 1952 mortality in the Northern Rocky Mtn. region.

Table 34.--Growth and cut by species group, 1952

Species group	Growing stock			Live sawtimber		
	Growth	Cut	Ratio of growth to cut[1]	Growth	Cut	Ratio of growth to cut[1]
	Billion cu. ft.	*Billion cu. ft.*		*Billion bd. ft.*	*Billion bd. ft.*	
Eastern softwoods:						
Southern yellow pine-----	3.48	3.03	1.15	14.15	11.61	1.22
White, red, and jack pine	.27	.26	1.05	.91	.97	.93
Spruce and balsam fir----	.29	.24	1.20	.74	.67	1.11
Other eastern softwoods--	.34	.22	1.56	1.17	.84	1.39
Total----------------	4.38	3.75	1.17	16.97	14.09	1.20
Eastern hardwoods:						
Oak---------------------	2.48	1.29	1.92	7.32	4.89	1.49
Sugar maple, beech, yellow birch-----------	.72	.33	2.21	1.88	1.29	1.46
Yellow poplar-----------	.29	.22	1.33	.95	.99	.96
Other eastern hardwoods--	3.59	1.41	2.54	8.97	5.04	1.78
Total----------------	7.08	3.25	2.18	19.12	12.21	1.57
Western softwoods:						
Douglas-fir-------------	.90	1.97	.46	4.43	11.96	.37
Ponderosa and Jeffrey pine-----------------	.48	.60	.79	1.84	3.60	.51
Western white and sugar pine-----------------	.10	.10	1.03	.53	.61	.88
Redwood-----------------	.08	.16	.47	.40	.99	.40
Other western softwoods--	1.07	.91	1.18	3.84	5.30	.72
	2.63	3.74	.70	11.04	22.46	.49
Western hardwoods----------	.15	.02	6.48	.27	.08	3.30
All species----------------	14.24	10.76	1.33	47.40	48.84	.97

[1] Ratios computed before rounding.

dominated the sawtimber growth picture that it exceeded the growth of all other softwoods combined, both eastern and western, and was not far behind the combined growth of all hardwoods. Douglas-fir dominated the growth of western softwoods, and the oaks accounted for nearly 40 percent of sawtimber growth of eastern hardwoods.

The distribution of growth among hardwood species is significant. Five of the more desirable hardwoods--white oak, red oak, yellow birch, sugar maple, and yellow poplar--accounted for less than 30 percent of eastern hardwood growth. A group of other hardwoods, increasingly used for pulpwood accounted for an additional 30 percent. Much of the remaining 40 percent of hardwood sawtimber growth is in less desirable species.

In terms of growing stock growth, the southern yellow pines again dominated the picture and accounted for one-fourth of the total. They are exceeded, however, by a miscellaneous group of eastern hardwoods which include many of the less desirable species.

Cut is Mainly Softwood Sawtimber

Timber cut is the term used to describe the volume of standing timber that is cut for various timber products or destroyed in logging whether removed from the woods or left unused. It includes therefore, logging residues and it is equivalent to "commodity drain" as used in the 1945 Reappraisal.

The flow of timber products from growing stock to end product in 1952 is graphically illustrated in figure 19 which shows the growing stock in-put from both East and West, the amount from cull and dead trees, and net imports, as well as losses due to logging and plant residues, and the final products.

Three-fourths of sawtimber cut is for sawlogs

Of the 48.8 billion board feet of timber cut in 1952 an estimated 36.6 billion feet, or 75 percent, was utilized for sawlogs. The next largest volume, or slightly under 10 percent of the total, was for pulpwood. Four principal items, sawlogs, pulpwood, veneer logs and bolts, and fuelwood, accounted for about 95 percent of sawtimber cut (table 35).

Table 35.--Timber cut on commercial forest land, 1952

Products	Growing stock			Live sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd. ft.*	*Billion bd. ft.*	*Billion bd. ft.*
Sawlogs	6.82	5.21	1.61	36.64	28.89	7.75
Veneer logs and bolts	.49	.25	.24	2.80	1.57	1.23
Cooperage logs and bolts	.10	.03	.07	.51	.14	.37
Pulpwood	1.73	1.46	.27	4.69	4.25	.44
Fuelwood	1.01	.25	.76	2.25	.60	1.65
Piling	.03	.03	(1)	.16	.15	.01
Poles	.10	.10	(1)	.47	.47	(1)
Posts	.13	.05	.08	.22	.07	.15
Hewn ties	.11	.03	.08	.48	.15	.33
Round mine timbers	.08	.02	.06	.10	.04	.06
Other	.16	.06	.10	.52	.22	.30
All products	10.76	7.49	3.27	48.84	36.55	12.29

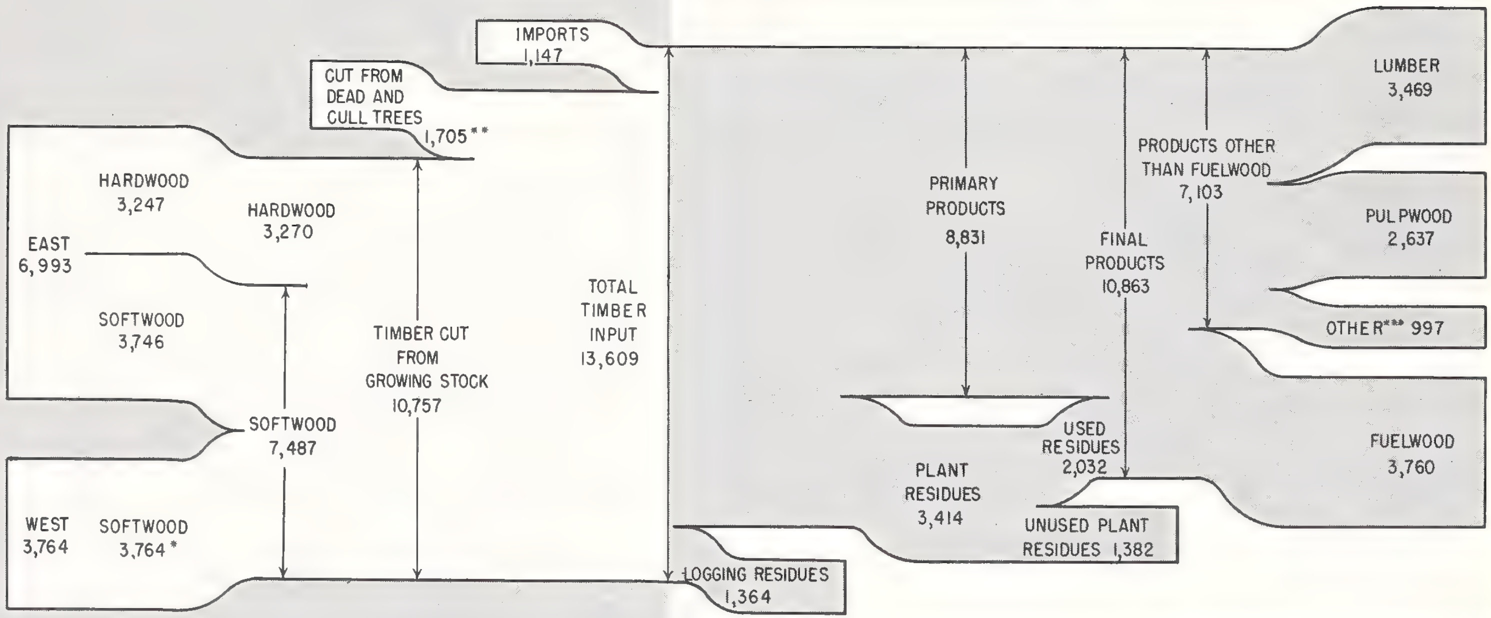
1 Less than 0.005.

Three-fourths of sawtimber cut is softwood

About 36.6 billion board feet, or 75 percent of total sawtimber cut in 1952 was softwood. Softwood likewise comprised about the same percentage of total growing stock cut (table 35). Softwoods accounted for practically the entire cut in the West. In the South about three-fifths of the cut was softwoods, but in the North the cut of hardwoods predominated in both sawtimber and growing stock.

Of the 10.8 billion cubic feet of growing stock cut for timber products only 1.7 billion was cut from poletimber. The remainder or 84 percent was cut from sawtimber trees. This shows how heavily the cut leans to the larger sawtimber size trees.

INPUT AND OUTPUT IN THE TIMBER ECONOMY, UNITED STATES, 1952



* Includes 23 million cubic feet of hardwoods.

** In addition to cull and dead trees, includes trees of commercial species less than 5.0 inches in diameter and tops less than 4.0 inches in diameter, and trees from noncommercial forest land.

*** Includes a small quantity of plant residues used in agriculture.

All figures in million cubic feet

Figure 19

Nearly half the sawtimber cut comes from the West

In 1952 about 22.5 billion board feet of sawtimber was cut in the West, excluding Coastal Alaska, or about 46 percent of the national total. In terms of cubic feet, however, the South lead with close to half of the total, followed by the West with about one-third (table 36[7]).

Table 36.--Timber cut by region, 1952

Section and Region	Growing stock			Live sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd. ft.*	*Billion bd. ft.*	*Billion bd. ft.*
North:						
New England	.50	.36	.14	1.76	1.38	.38
Middle Atlantic	.47	.13	.34	1.80	.51	1.29
Lake States	.54	.19	.35	1.24	.38	.86
Central	.40	.02	.38	1.81	.09	1.72
Plains	.03	(1)	.03	.09	.01	.08
Total, North	1.94	.70	1.24	6.70	2.37	4.33
South:						
South Atlantic	1.46	.92	.54	5.35	3.36	1.99
Southeast	2.41	1.48	.93	9.41	5.72	3.69
West Gulf	1.19	.65	.54	4.84	2.64	2.20
Total, South	5.06	3.05	2.01	19.60	11.72	7.88
West:						
Pacific Northwest:						
Douglas fir subregion	2.03	2.02	.01	12.22	12.17	.05
Pine subregion	.36	.36	(1)	2.05	2.05	(1)
Total	2.39	2.38	.01	14.27	14.22	.05
California	.93	.92	.01	5.72	5.70	.02
Northern Rocky Mountain	.33	.33	(1)	1.90	1.90	(1)
Southern Rocky Mtn.	.10	.10	(1)	.56	.55	.01
Total, West	3.75	3.73	.02	22.45	22.37	.08
Continental United States	10.75	7.48	3.27	48.75	36.46	12.29
Coastal Alaska	.01	.01	--	.09	.09	--
All regions	10.76	7.49	3.27	48.84	36.55	12.29

1 Less than 0.005.

It is also significant that between 1944 and 1952 the West was providing an increasing proportion of the total cut (table 37). While there was no significant difference in the total cut of sawtimber between the two years, the sawtimber cut in the West rose 20

7 Table 45 is the fourth and last in a series of regional tables in this chapter. Most tabular material is by section or other arrangement and regional data are largely confined to the individual chapters or appendix. The four regional tables included in this summary are those relating to forest land (table 15), timber volumes (table 22), timber growth (table 33), and timber cut (table 36).

percent, reflecting mainly an increase in California where cut more than doubled in the interim. In contrast, the sawtimber cut of eastern softwoods dropped 16 percent between 1944 and 1952, and cut of eastern hardwood sawtimber dropped 13 percent. This increased dependence on the West will not be continued indefinitely. The trend will be reversed as western old-growth is cutover, and as cut is more nearly related to forest area and growth capacities of the land. The decreases in the sawtimber cut of eastern softwoods and eastern hardwoods may explain in part the increases in the timber growth of those species groups (table 32). Likewise the increase in cut of western species may explain in part the decrease in growth of those species as shown in the same table.

Table 37.--Comparison of timber cut in Continental United States, 1944 and 1952

Species group	Growing stock			Live sawtimber		
	1944	1952	Difference	1944	1952	Difference
	Billion cu. ft.	*Billion cu. ft.*	*Percent of 1944*	*Billion bd. ft.*	*Billion bd. ft.*	*Percent of 1944*
Eastern softwoods--------	4.1	3.8	-7	16.9	14.1	-16
Eastern hardwoods--------	4.2	3.2	-24	14.0	12.2	-13
Western species----------	3.4	3.7	+9	18.8	22.5	+20
All species--------------	11.7	10.7	-8	49.7	48.8	-2

One-fourth of timber cut not utilized

Of the total timber cut in 1952, one foot out of every four or 2.7 billion cubic feet was not utilized (table 38). This is comprised almost equally of unused plant residues and of logging residues. By definition, logging residues include only the growing stock cut or killed in logging which does not find its way into some use. Such material that is initially left on the ground and subsequently used in salvage logging, or logging for

Table 38.--Total residues 1952

Source	Plant residues		Logging residues	Unused residues	
	Used	Unused		Total	Relation to timber cut
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Percent*
Lumber----------------------------	1,619	1,331	1,020	2,351	34
Veneer----------------------------	180	25	100	125	25
Cooperage-------------------------	27	13	33	46	44
Pulp------------------------------	170	--	72	72	4
Other[1]--------------------------	36	13	139	152	9
Total-----------------------	2,032	1,382	1,364	2,746	26
North-----------------------------	328	143	213	356	18
South-----------------------------	758	716	705	1,421	28
West and Coastal Alaska-----------	946	523	446	969	26
Total-----------------------	2,032	1,382	1,364	2,746	26

[1] Includes shingle mills, box board, small dimension, turnery and excelsior plants, and other similar establishments utilizing roundwood.

another product, is not included in logging residues. One-third of the timber cut for lumber is unused, but only 4 percent of that cut for pulp. About the same proportion (28 and 26 percent) of timber cut is unused in both the South and the West, but the North with 18 percent unused would appear to have significantly closer utilization. Logging and unused plant residues can, of course, never be completely eliminated. However, reduction in residues is one effective way of meeting increased needs for timber products and making local timber supplies go further. Reduction in the material loss rate of 34 percent for lumber affords the greatest opportunity and challenge, both because of the high rate and because of the large quantity of material involved.

Growth-cut and Volume Relations Summarized

For ready comparisons of the more significant facts on timber volumes with those on growth and cut, three simple summaries are made at this point (1) proportions of forest area, sawtimber volume, growth, and cut are shown by hardwoods and softwoods; (2) the same by East and West; and (3) relative importance of five principal species, or species groups, are shown in terms of both volume and growth and cut.

The hardwood forest types which cover about half the commercial forest area, support only 20 percent of the sawtimber volume, supply about 40 percent of the growth, but only 25 percent of the cut. Conversely, the softwood types likewise covering about half the commercial forest area support 80 percent of the sawtimber volume, but furnish only 60 percent of the growth while yielding 75 percent of the cut:

	Softwood (percent)	Hardwood (percent)
Forest types on commercial forest land-------	52	48
Live sawtimber volume --------------------	80	20
Net annual growth of sawtimber --------------	59	41
Annual cut of sawtimber--------------------	75	25

On an East-West breakdown, the East has 75 percent of the forest area but supports only 30 percent of the volume. Its growth is 76 percent of the total, yet it yields only 54 percent of the total cut. Conversely the West has one-fourth of the area and one-fourth of the growth. But it has 70 percent of the volume and almost half the cut:

	East (percent)	West and Coastal Alaska (percent)
Commercial forest area-----------------	75	25
Live sawtimber volume -----------------	30	70
Net annual growth of sawtimber -----------	76	24
Annual cut of sawtimber-----------------	54	46

Five of the leading species, or species groups, in terms of both growing stock and sawtimber volume, are Douglas-fir, ponderosa and Jeffrey pine, western true firs, southern yellow pine, and the oaks. These account for three-fifths of the sawtimber volume and growth, and 70 percent of the cut. Variations between species, however, are of most significance. The southern yellow pines with only 8 percent of the volume supply one-fourth of the cut and 30 percent of the growth, whereas Douglas-fir with one-fourth of the volume and one-fourth of the cut represents only 9 percent of the growth (table 39).

In terms of growing stock, southern yellow pine with 9 percent of the volume accounts for about a quarter of both the growth and the cut. The oaks with 10 percent of the volume account for 12 percent of the cut and 17 percent of the growth.

It is apparent from these comparisons, and others that can be drawn from table 39, that a small group of species comprise the foundation of our timber supplies. It is also

Table 39.--Comparison of volume, growth, and cut by principal species groups, 1952

LIVE SAWTIMBER

Species group	Volume	Growth	Cut
	Percent	*Percent*	*Percent*
Douglas-fir	26	9	24
Ponderosa and Jeffrey pine	11	4	7
Western true firs	9	3	3
Southern yellow pine	8	30	24
Oaks	7	15	10
Total	61	61	70

GROWING STOCK

Species group	Volume	Growth	Cut
	Percent	*Percent*	*Percent*
Douglas-fir	19	6	18
Oaks	10	17	12
Southern yellow pine	9	24	28
Ponderosa and Jeffrey pine	8	3	6
Western true firs	7	2	2
Total	53	52	66

apparent that in terms of both sawtimber and growing stock, these species represent a greater proportion of total cut than they do of either growth or volume.

Over-all growth-cut comparisons have little significance

One of the most natural comparisons to make in attempting to appraise in simplified terms the complex timber situation is to determine whether growth exceeds or is less than cut. Total growth has been compared frequently with total cut in the past by many interested groups including the Forest Service, but this is gross over-simplification and unless carefully qualified and explained may well mislead the reader or conceal important relations.

There are four main reasons why an over-all growth-cut relationship has relatively little significance:

(1) The mature old-growth forests of the West are still being cut. These forests show little net growth, but heavy volumes. Until these old-growth areas are harvested and replaced by new second growth forests, it can be expected that cut will continue to exceed growth in the West. To incorporate this unusual growth-cut relationship into over-all national figures would be inappropriate.

(2) Growth-cut relationships between hardwoods and softwoods are significantly different and softwood and hardwood species are not interchangeable in their merchantability and utility. In over-all comparisons adverse softwood relations may be overbalanced by favorable hardwood relationships, thus concealing the more significant softwood situation.

(3) Equally important, or perhaps more important, than whether growth exceeds or is less than cut is the level at which such relationship occurs. In other words, a balance between growth and cut at 1952 levels is of little significance if future requirements will bring a demand for cut (and growth to meet it) at much higher levels. To carry the illustration to an absurdity, there would be a balance be-

tween growth and cut if there were no growth and no cut. Thus the balance is not significant unless it is at a sufficiently high level to meet the country's needs.

(4) Growth-cut relationships are frequently different depending on whether they are expressed in terms of sawtimber or growing stock. Usually growing stock growth-cut ratios are more favorable than those for sawtimber, which means that growth-cut ratios are better when merchantable trees of all sizes are considered than when consideration is given only to the larger and generally higher quality trees. So long as most of the cut comes from sawtimber (84 percent) whereas growth is more equally distributed among the large and the small trees, the tendency is for timber to decline in average size. Favorable growth-cut balances in terms of growing stock do not reflect the decreasing size of timber. That is why the Forest Service continues to believe that growth-cut information for sawtimber is more significant than that for growing stock.

In view of the above qualifications, the more significant growth-cut comparisons--although all are deficient with respect to the question of whether they are at adequate levels--are those pertaining to sawtimber, eastern softwoods, eastern hardwoods, and by these groups for the North and the South. Growth-cut ratios for western species have little meaning.

Softwood growth exceeds cut in the East

The most significant of all growth-cut relationships is that growth of eastern softwood sawtimber exceeded cut in 1952 by 20 percent (tables 34 and 40). In the North the plus margin for softwood sawtimber was 4 percent, in the South 24 percent. These favorable balances are tempered by the realization that they were achieved as much by the 16 percent reduction in cut of eastern softwoods since 1944 as by the 12 percent increase in growth. Also, both growth and cut are far below productive capacity of the land.

Table 40.—Growth and cut by softwood and hardwood, and by section, 1952

Species group and section	Growing stock			Live sawtimber		
	Growth	Cut	Ratio of growth to cut[1]	Growth	Cut	Ratio of growth to cut[1]
	Billion cu. ft.	*Billion cu. ft.*		*Billion bd. ft.*	*Billion bd. ft.*	
All species:						
North	4.66	1.94	2.42	12.07	6.70	1.80
South	6.81	5.06	1.33	24.02	19.60	1.22
West and Coastal Alaska	2.77	3.76	.76	11.31	22.54	.50
Total	14.24	10.76	1.33	47.40	48.84	.97
Softwood:						
North	.82	.70	1.14	2.47	2.37	1.04
South	3.57	3.05	1.16	14.50	11.72	1.24
West and Coastal Alaska	2.62	3.74	.70	11.04	22.46	.49
Total	7.01	7.49	.93	28.01	36.55	.77
Hardwood:						
North	3.84	1.24	3.17	9.60	4.33	2.23
South	3.24	2.01	1.60	9.52	7.88	1.20
West and Coastal Alaska	.15	.02	6.48	.27	.08	3.30
Total	7.23	3.27	2.25	19.39	12.29	1.58

[1] Ratios computed before rounding.

Eastern hardwood growth exceeded cut of sawtimber by 57 percent (fig. 20). As would be expected, the more preferred hardwoods in general have less favorable ratios than the less desired species.

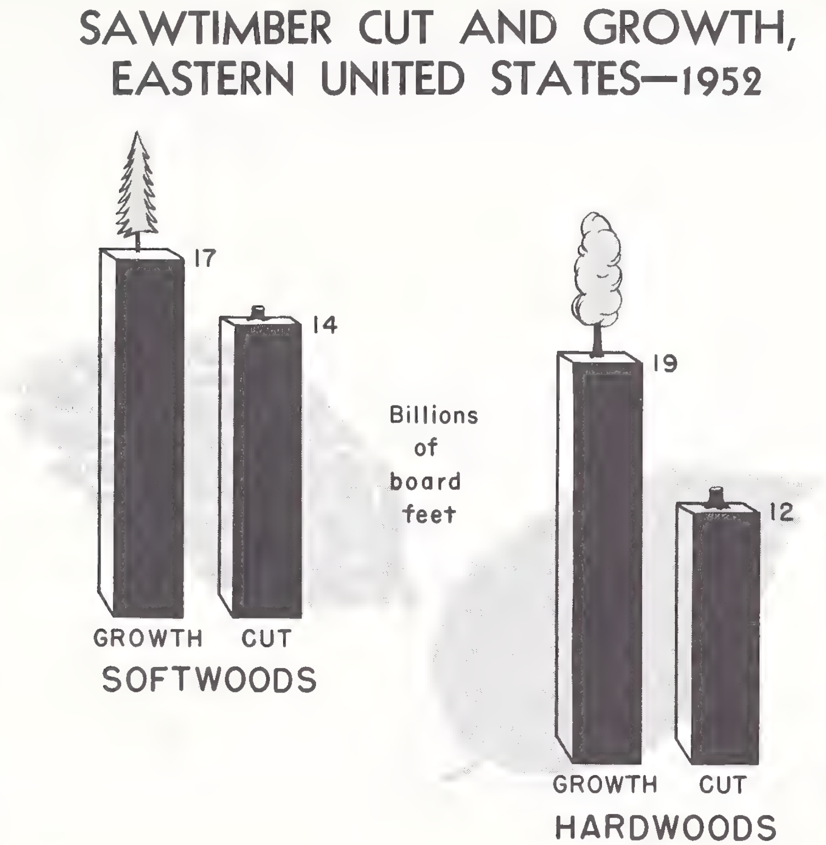


Figure 20

In the West the situation is quite different and, in terms of sawtimber, growth is only about half of cut, but as previously emphasized this is due to the residual of old-growth timber in the West and recent increases in the rate of timber cut. Growth-cut comparisons by section and by softwood and hardwood are summarized in figure 21.

Most eastern species have favorable growth-cut ratios

Among eastern softwoods, all appear to have favorable sawtimber growth-cut ratios except the white, red, and jack pine group. The southern yellow pines, which, of course, dominate the eastern picture, show growth to be 22 percent in excess of cut of sawtimber. In terms of eastern hardwoods, yellow poplar has an adverse sawtimber ratio. But for other soft- and generally preferred hardwoods, growth exceeds cut by more than 50 percent. For a group of so-called "other 'hard' hardwoods", --which includes many relatively undesirable species--growth is two and one-half times cut. These differences

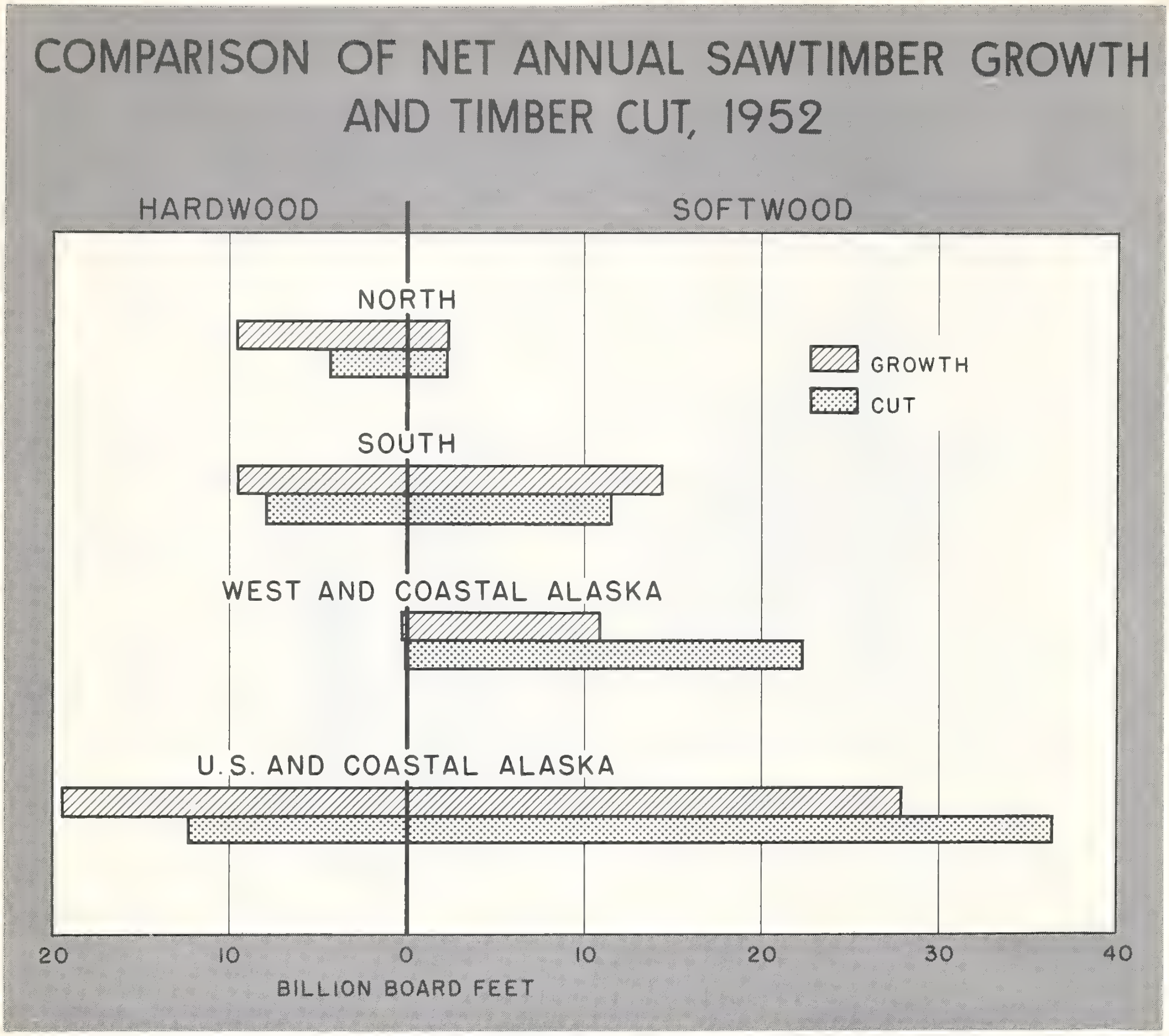


Figure 21

point to declining quality with respect to our future timber supply in terms of species composition. The ratio of growth to cut for the various species groups is as follows:

Species group	Sawtimber	Growing stock
East:		
Spruce and fir	1.11	1.20
White, red, and jack pine	.93	1.05
Southern yellow pines	1.22	1.15
Other eastern softwoods	1.39	1.56
Yellow poplar	.96	1.33
Other "soft" hardwoods	1.55	2.17
Oak	1.49	1.92
Sugar maple, beech, and yellow birch	1.46	2.21
Other "hard" hardwoods	2.56	3.66

Species group	Sawtimber	Growing stock
West:		
Douglas-fir	.37	.46
Ponderosa and Jeffrey pine	.51	.79
Western hemlock	.47	.63
White and sugar pine	.88	1.03
Redwood	.40	.47
Other western softwoods	.91	1.56
Western hardwoods	3.30	6.48

Growth-cut ratios have improved in the past decade

One of the most favorable features of growth-cut comparisons with respect to future outlook is that since 1944 ratios of growth to cut of both eastern softwoods and hardwoods have distinctly improved. After adjusting 1944 estimates to be comparable to 1952, it appears that in 1944 growth of eastern softwood sawtimber was only 90 percent of cut in contrast to the 20 percent excess over cut in 1952 (table 41).

Table 41.—Comparison of sawtimber growth and cut in Continental United States, 1944 and 1952

Species group	1944[1]		1952	
	Billion bd. ft.	Ratio of growth to cut	*Billion bd. ft.*	Ratio of growth to cut
All species:				
Growth	43.4	.88	47.4	.97
Cut	49.7		48.8	
Eastern softwoods:				
Growth	15.2	.90	17.0	1.20
Cut	16.9		14.1	
Western softwoods:				
Growth	11.3	.60	10.9	.49
Cut	18.7		22.4	
Hardwoods:				
Growth	16.9	1.19	19.4	1.58
Cut	14.1		12.3	

[1] Adjusted to 1952 basis.

Similarly, hardwoods showed an excess of sawtimber growth over cut of 19 percent in 1944 in contrast to 58 percent in 1952.

In western softwoods the trend has been in the opposite direction and whereas growth of sawtimber was 60 percent of cut in 1944, it was only 49 percent of cut in 1952. This is an undesirable trend and is explained probably by the 20 percent increase in cut of western species since 1944, and a 3 percent decrease in growth due apparently to accelerated cutting in second-growth softwood stands and abnormally heavy insect losses in the Northern Rocky Mountain region in 1952.

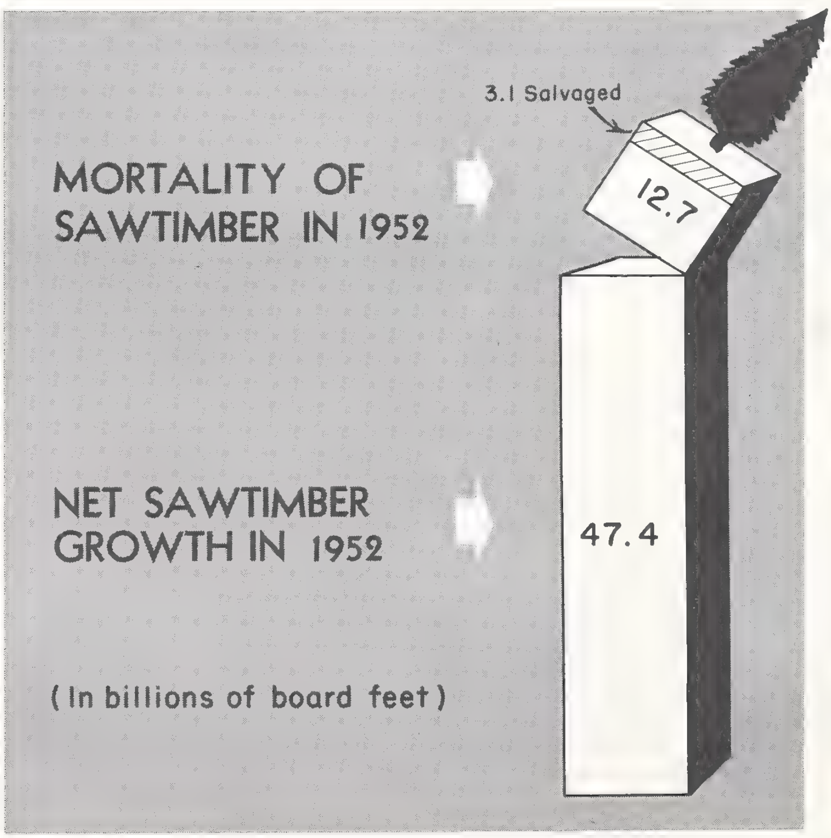
PROTECTION AGAINST DESTRUCTIVE AGENTS

One of the greatest deterrents to present and future productivity of forest land is the damage caused by fire, insects, disease, weather, animals, and other destructive agents. These affect growth in many ways. They kill trees. They weaken tree vitality and slow up growth. Trees may be deformed or stunted. Seed may be eaten and seedlings eaten, grubbed out, trampled, or broken. Everyone is familiar with the damage that may be wrought by ice, snow, flooding, blowdown, and drought. Understocking may result from these agents, as may site deterioration, and encroachment of inferior species.

The estimated total mortality in 1952 from all destructive agents was 12.7 billion board feet, or about one-fourth of net sawtimber growth (fig. 22). About 3.1 billion board feet were salvaged. If these losses could be further materially reduced, the added timber available for use would go a long way towards meeting the country's increasing needs. Growth-cut relationships in both sawtimber and growing stock would become more favorable in many localities, and potential demand estimates would appear much more attainable.

Fire now ranks lower than either insects or disease as a destructive agent in terms of either mortality or the more inclusive concept of growth impact. In addition, in 1952, fire caused only about one-fourth as much mortality as did weather. Probably the major reason why damage estimates show other causes to be so much more serious than fire is because of the tremendous strides made in forest fire prevention and control, and the much more effective action against fire than against other destructive agents. Fire remains an extremely important menace to forest productivity even under present-day in-

Destructive forces still reap a big harvest in the United States



Includes Coastal Alaska

Figure 22

tensity of prevention and control effort. If these efforts were relaxed, fire could easily become the number one destroyer of the forest.

Growth Impact--A Concept for Estimating Total Losses

In attributing losses due to various destructive agents, an effort has been made to reflect their full impact on growth. It has long been recognized that mortality loss occasioned by a destructive agent may be insignificant, yet the annual loss in volume of sound standing timber, through reduced growth, may be very large over a period of years. Thus, although heart rots seldom kill trees, they lead all agents in the amount of damage caused.

For the first time in the Timber Resource Review, nationwide estimates have been developed for both mortality and this additional loss of growth.

A new term used to describe this total damage is "growth impact". It consists of two elements, (1) mortality, which simply means loss of trees through death from natural causes and (2) growth loss.

Growth loss consists of (a) reductions in growth due to reduced tree vigor, increase in amount of cull, site deterioration, defoliation, or any other factors reducing growth; (b) losses in growth as a result of delays or deficiencies in stocking resulting from a destructive agent; and (c) losses in growth and prospective yields due to the killing of trees below measured size. Thus growth impact, as used in the Timber Resource Review, consists of mortality in 1952, plus the growth losses in 1952 and subsequent years resulting from 1952 events. Growth impact, a new term for something that has long been recognized, is discussed more completely in Chapter IV. It is believed to be a more sound and realistic indicator of the true effect of destructive agents than is mortality alone.

However, because growth impact includes losses during a period of years subsequent to a destructive event, it may not properly be compared to growth in the year in which the event occurred. This explains why, in estimating net growth for a single year, mortality alone is deducted from gross growth. Nevertheless, comparisons of mortality and growth impact as subsequently presented show that the latter may exceed mortality three to four times. This means that traditional bench marks as to the significance of destructive agents will need to be greatly revised upward.

Estimates of damage from destructive agents in the Timber Resource Review are not comparable to damage estimates made in the 1945 and earlier appraisals of the timber situation for two reasons:

(1) The Timber Resource Review includes both epidemic and endemic losses from insects, and disease, whereas earlier appraisals included only estimates of epidemic timber losses not salvaged. As a result, mortality in the Timber Resource Review is more than three times that of earlier estimates.

(2) Estimates of growth impact have been developed. This has not been done before on a national scale. In cubic feet the growth impact from destructive agents other than fire is more than nine times that of the mortality loss given in the 1945 Reappraisal. Failure to understand these differences might lead to the erroneous conclusion that little progress has been made in controlling many of the more serious insect and disease epidemics. Such a conclusion would not be justified.

In addition to the insect, disease, fire and other losses which form the basis for the mortality and growth impact estimates in the Timber Resource Review, there are the so-called "catastrophic" losses, which are of extraordinary severity and so unusual as to be unpredictable as to location or frequency. These losses are discussed separately and are one of the major reasons why a "margin" needs to be added to estimates of the growth needed to meet potential demand estimates.

Destructive Agents Take Extraordinary Toll

As noted earlier, mortality of sawtimber in 1952 as the result of damage by fire, disease, insects, weather, and other factors, was 12.7 billion board feet. Growth impact was nearly 4 times greater or 43.8 billion board feet (table 42). These estimates, however, represent total losses without allowance for the amount of dead timber that was utilized. This salvage amounted to about 770 million cubic feet of growing stock including over 3 billion board feet of sawtimber. Thus, for sawtimber, there was a net loss due to mortality of 9.6 billion board feet, and of 40.7 billion board feet due to growth impact. In terms of growing stock the net losses were 2.7 billion cubic feet of mortality and 10.4 billion cubic feet of growth impact.

Table 42.—Mortality and growth impact resulting from 1952 damage, by cause.

GROWING STOCK

Cause	Mortality[1]		Growth impact	
	Million cu. ft.	*Percent*	*Million cu. ft.*	*Percent*
Fire	240	7	1,690	15
Disease	770	22	5,050	45
Insects	1,000	28	1,780	16
Weather	840	24	960	9
Animals	70	2	1,000	9
Other	590	17	730	6
Total	3,510	100	11,210	100
Salvage	-770	---	-770	---
Net loss	2,740	---	10,440	---

LIVE SAWTIMBER

Cause	Mortality[1]		Growth impact	
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Percent*
Fire	780	6	7,370	17
Disease	2,240	18	19,890	45
Insects	5,040	40	8,620	20
Weather	3,390	27	3,870	9
Animals	190	1	2,720	6
Other	1,030	8	1,360	3
Total	12,670	100	43,830	100
Salvage	-3,090	---	-3,090	---
Net loss	9,580	---	40,740	---

[1] Estimates represent actual mortality in 1952. They differ slightly from estimates presented in table 33 which represent the current level of mortality as indicated by trends over a long period of years, as determined in 1952.

On a sectional basis, about 70 percent of sawtimber mortality occurred in the West. The remainder was about equally divided between the North and South (table 43). In terms of growth impact, however, the distribution of loss was quite different and was almost equally divided between all sections of the country.

Table 43.--Mortality and growth impact resulting from 1952 damage, by section.

GROWING STOCK

Section	Mortality[1]		Growth import	
	Million cu. ft.	*Percent*	*Million cu. ft.*	*Percent*
North	1,150	33	4,310	38
South	630	18	4,000	36
West and Coastal Alaska	1,730	49	2,900	26
Total	3,510	100	11,210	100
Salvage	-770	--	-770	--
Net loss	2,740	--	10,440	--

LIVE SAWTIMBER

Section	Mortality[1]		Growth import	
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Percent*
North	2,080	16	13,840	32
South	1,770	14	15,440	35
West and Coastal Alaska	8,820	70	14,550	33
Total	12,670	100	43,830	100
Salvage	-3,090	--	-3,090	--
Net loss	9,580	--	40,740	--

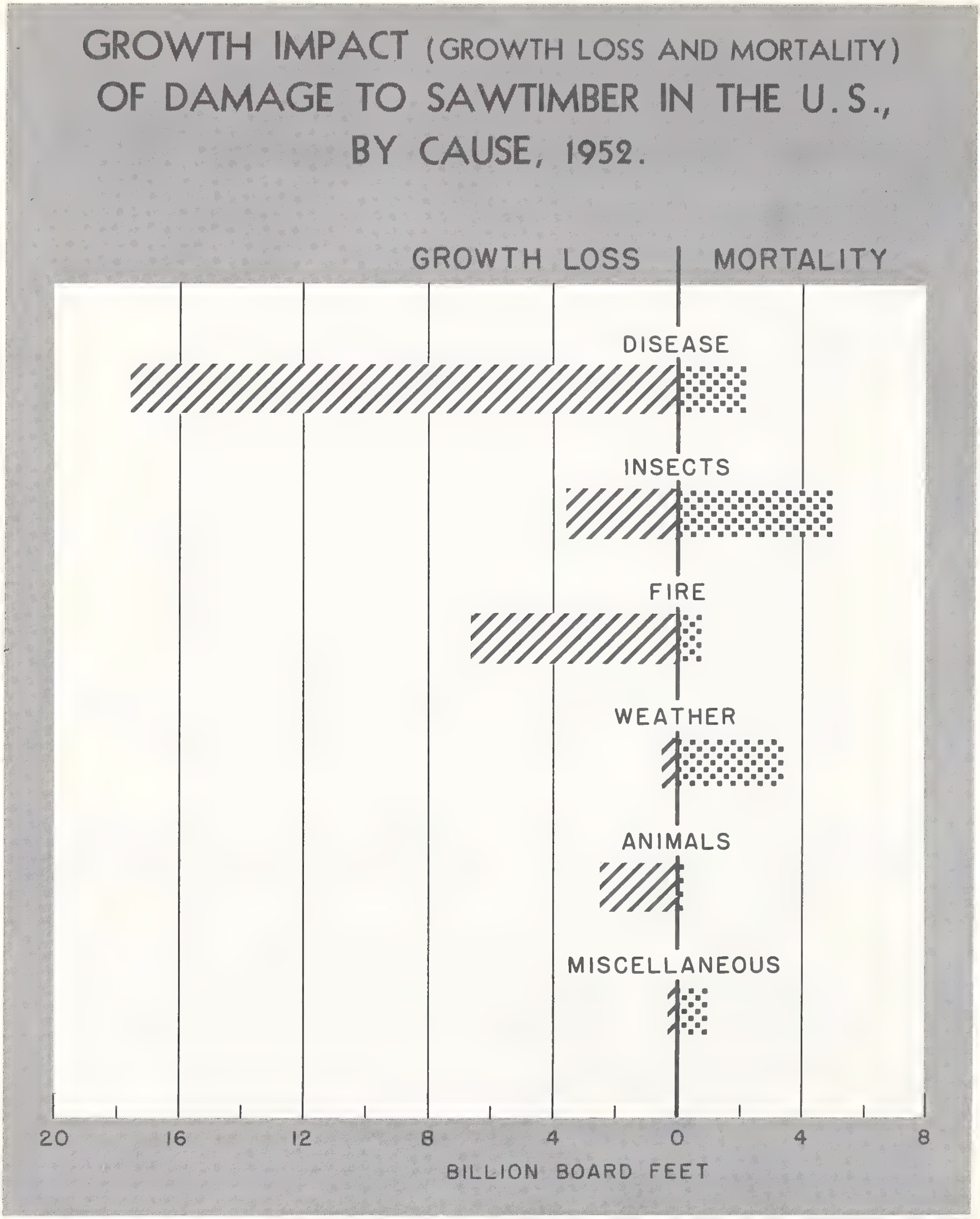
[1] Estimates represent actual mortality in 1952 in contrast to estimates appearing in table 33 which represent the current level of mortality as indicated by trends over a long period of years, as determined in 1952. The estimates are the same in either case, except for the West.

By causative agents, disease, insects, and fire were the most important, regardless of whether the comparisons are in terms of sawtimber or growing stock, growth impact or mortality, except that weather in 1952 outranked fire as a mortality cause with respect to both sawtimber and growing stock (table 42). These relationships are shown graphically for sawtimber in figure 23.

Damage ascribed to weather, animals, and a miscellaneous group of other factors is significant and should not be overlooked. Weather damage from wind, ice and snow, lightning and drouth caused greater mortality than fire in 1952, but had far less growth impact. In that year damage from weather was far greater in the West than in other sections. Damage from a variety of animals including domestic livestock, big game, porcupines, squirrels, and mice, is more serious in the North and West than in the South. Such damage can be controlled or reduced.

Insects Cause the Greatest Mortality

Insects were responsible for 40 percent of all the mortality of sawtimber in 1952, and 28 percent of the mortality of growing stock. In terms of sawtimber, insects outrank disease as a cause of mortality by a ratio of 2 to 1, and fire by a ratio of 7 to 1. In terms of the longer range effects of growth impact, however, insects were only about half as damaging as disease, and about on a par with fire as a destructive agent.



Includes Coastal Alaska

Figure 23

On a sectional basis, insects were far more important in the West than in other sections, and of least importance in the North (table 44). Ninety percent of all sawtimber mortality caused by insects was in the West, and about half of all sawtimber mortality in the West from all causes was due to insects.

Table 44.--Timber mortality on commercial forest land, 1952.[1]

GROWING STOCK

Cause	All sections	North	South	West and Coastal Alaska
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Fire	240	40	130	70
Disease	770	460	70	240
Insects	1,000	70	110	820
Weather	840	210	120	510
Animals	70	40	(2)	30
Other	590	330	200	60
Total	3,510	1,150	630	1,730
Salvage	-770	-150	-240	-380
Net loss	2,740	1,000	390	1,350

LIVE SAWTIMBER

Cause	All sections	North	South	West and Coastal Alaska
	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*
Fire	780	70	300	410
Disease	2,240	910	230	1,100
Insects	5,040	100	410	4,530
Weather	3,390	500	400	2,490
Animals	190	80	(2)	110
Other	1,030	420	430	180
Total	12,670	2,080	1,770	8,820
Salvage	-3,090	-280	-620	-2,190
Net loss	9,580	1,800	1,150	6,630

[1] See footnote 1, table 42.
[2] Less than 5.

There are many different kinds of insects. Bark beetles are by far the most important group, and are responsible for 90 percent of insect-caused mortality. In terms of growth impact, bark beetles are somewhat less important, and the defoliators and other insect groups become more important. However, even with respect to growth impact, bark beetles account for three-fifths of the insect damage (table 45 and figure 24). The "other insects" group includes hardwood borers, white pine weevil, pine tip moth, turpentine borer, cone and seed insects, Saratoga spittlebug, and balsam wooly aphid.

Disease Causes the Greatest Growth Impact

Diseases far outrank all other causative agents in their total adverse effects on forest productivity. Although diseases do not kill as much timber outright as do insects

Table 45.—Sawtimber mortality from insects and disease in 1952 and growth impact of 1952 damage.

INSECTS

Cause	Mortality[1]		Growth impact	
	Million bd. ft.	*Percent*	*Million bd. ft*	*Percent*
Bark beetles	4,530	90	5,410	63
Defoliators	30	1	1,310	15
Other insects	480	9	1,900	22
All insects	5,040	100	8,620	100
DISEASE				
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Percent*
Heart rot and other stem diseases	610	27	16,170	81
Systemic diseases	360	16	640	3
Root diseases	290	13	600	3
Foliage diseases	40	2	110	1
Other diseases	940	42	2,370	12
All diseases	2,240	100	19,890	100

[1] See footnote 1 table 42.

or weather, their total growth impact is far greater. In terms of either sawtimber or growing stock, diseases account for 45 percent of the growth impact caused by all destructive agents (table 42).

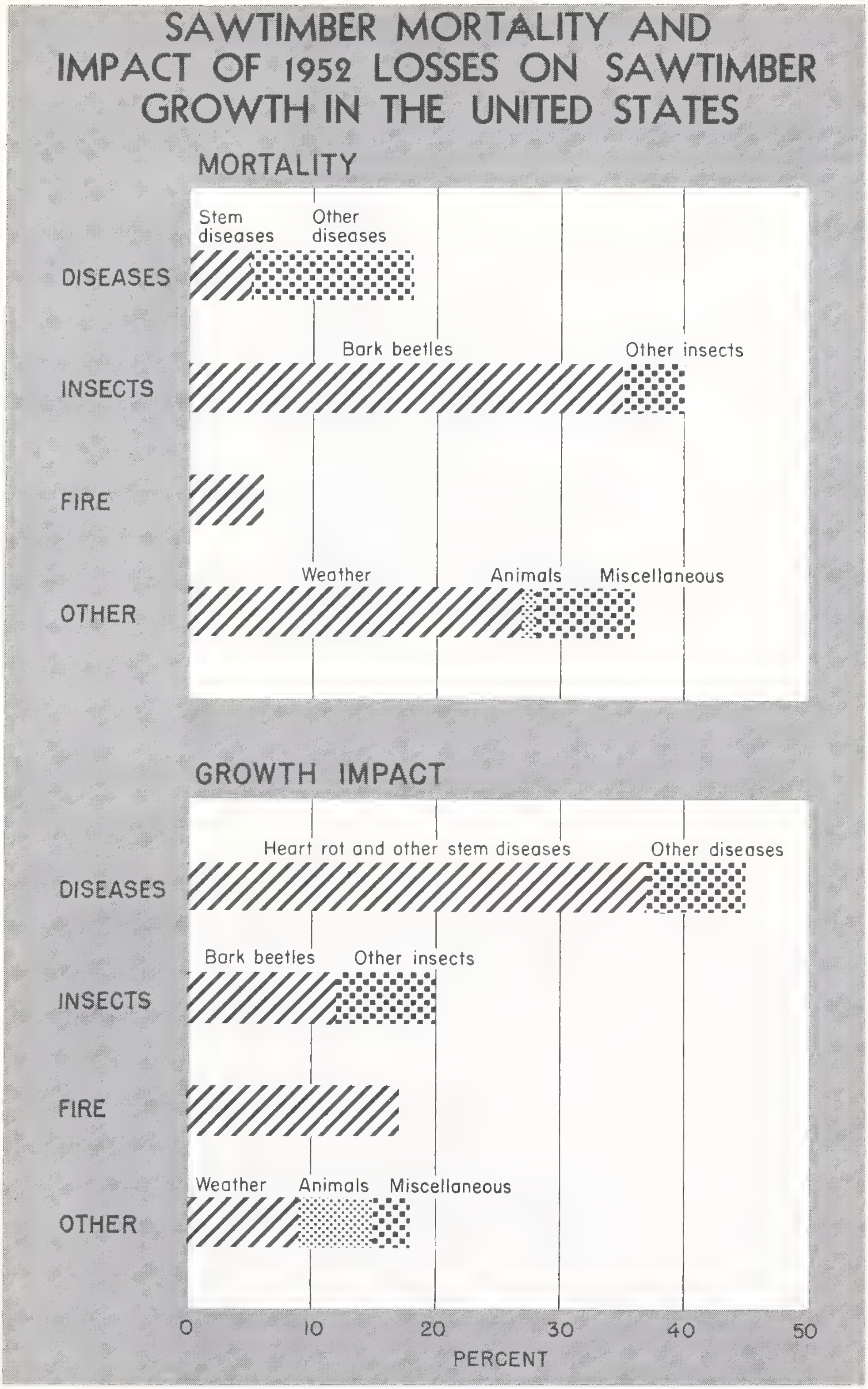
Sectionally, disease occasions the greatest growing stock mortality in the North, and the greatest sawtimber mortality in the West. The South ranks relatively low compared to other sections in extent of disease mortality (table 44).

One reason why diseases rank higher than other destructive agents, in terms of growth impact and lower than insects in terms of mortality is because many diseases such as the heartrot, leaf diseases and the killers of seedlings and saplings cause little mortality of growing stock, yet account for a large share of the ultimate effect of disease on production of wood. Most of the forest tree diseases are native, but occasionally these normally endemic diseases become epidemic. Some of our most destructive diseases, for example, the white pine blister rust and the chestnut blight, are not native, but have been introduced from other continents.

Heartrot and other stem diseases are the most important single group. They cause 27 percent of disease mortality, and over 80 percent of the growth impact due to diseases. Other important groups in terms of mortality caused by disease are the systemic diseases which include birch dieback, pole blight, oak wilt, and sweetgum blight, and the root diseases including Douglas-fir rootrot and littleleaf disease of shortleaf pine.

Fire is Potentially the Greatest Enemy

The effects of fire, as is true with other agents but possibly to a somewhat lesser degree, vary a great deal from year to year. From the standpoint of area burned, 1952 was slightly worse than the average for the previous 5-year period. In 1952, fire accounted



Includes Coastal Alaska

Figure 24

for 6 percent of the total sawtimber mortality, and 7 percent of the growing stock mortality. In terms of the longer-range growth impact, fire was relatively more important and accounted for about 15 percent of the total damage caused by all destructive agents.

Moreover, fires often set the stage for subsequent attacks by insects and diseases. They often destroy wildlife and forage for domestic livestock and big game. Likewise, fires occasionally result in loss of human life, and severe fires are often followed by floods and accelerated erosion.

Mortality from fire was most serious in the West in terms of sawtimber, and in the South in terms of growing stock. In relation to other causative agents, fire is much more a factor in the South than either in the North or in the West (table 44).

Fire was the first of the serious destructive agents which was aggressively attacked through the organized and cooperative efforts of Federal, State, and local governments and owners of private forest land. Great progress has been made as shown by such criteria as the area protected in relation to the total area needing protection, the class of protection applicable to different areas, and the area burned each year.

An estimated 673 million acres in the United States needs protection from fire. This includes all commercial forest land and approximately 185 million acres of noncommercial forest land.[8] Noncommercial forest land needs protection because it is intermingled with or adjacent to commercial timberlands or is highly important watershed land. Eighty-eight percent, or 591 million acres, of the total needing protection now receives it in some degree (fig. 25). Nearly 100 percent of Federal ownerships receive some degree of protection, 93 percent of other public ownerships, and 81 percent of the private forest land (table 46).

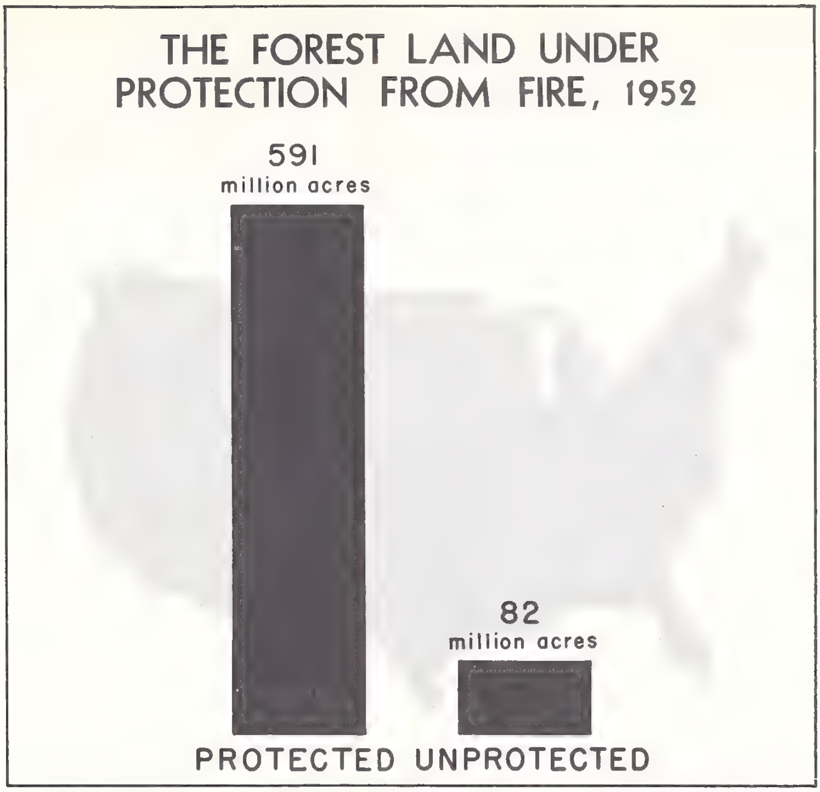
Table 46.--Status of protection from fire 1952.

Ownership	Area requiring protection	Protection adequate for--		
		Worst years	Average years	Easy years
	Million acres	*Percent*	*Percent*	*Percent*
Private	425	12	69	81
National forest	140	16	84	100
Bureau of Land Management	40	23	77	100
Indian	18	4	93	97
National Park	6	42	58	100
Other Federal	11	3	90	93
Other public	33	35	58	93
All ownerships	673	15	73	88

Though 88 percent of the area needing protection receives adequate protection only in easy years, and though 73 percent is protected sufficiently well to meet the fire situation in the average year, only 15 percent is protected adequately to meet the fire situation in worst years and under peakload conditions (fig. 26).

The degree of protection varies considerably by ownership, particularly with respect to protection which is adequate to meet the situation in the worst and average years. Only 12 percent of the private land and 16 percent of the national forests receive a degree of

[8] In addition, a relatively small acreage of 10 million acres of nonforest land in California and North Dakota is included in these estimates and cannot be readily segregated.



Includes Coastal Alaska

Figure 25

Though most of the forests in the United States are protected from fire the protection is not adequate in all years

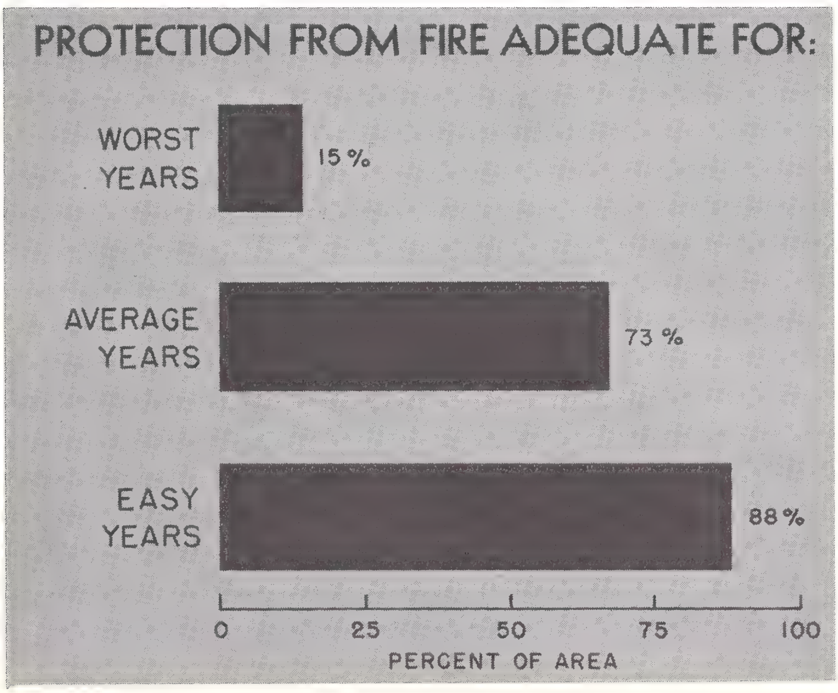


Figure 26

protection sufficient to adequately meet the situation in the worst years (table 46). In contrast, national parks are the best protected with 42 percent adequately protected even in the worst years.

The long-time trend in the area of forest land burned each year has been steadily downward during the last quarter of a century for which fairly reliable statistics have been available. This reflects a steady improvement in the effectiveness of the Nation's forest fire prevention and control efforts. For example, the average annual area burned during 1926-30 was 41.6 million acres. This decreased rather steadily with minor fluctuations to the most recent 5-year average annual estimate of 11 million acres for 1951-54.

There were 128 thousand forest fires in the United States in 1952, one-third of which were incendiary fires. An additional 61 percent were also man-caused. Six percent of the fires were due to lightning. Of the man-caused fires (excluding incendiary) the chief causes were debris burning (20 percent) smoking (20 percent), camping (4 percent) and railroads and lumbering (5 percent). In comparison to some of the estimates for 1941-45, the percentage of lightning fires doubled and the percentage of railroad and lumbering fires was almost halved, but the other man-caused fires continued to account for close to 90 percent of the total.

Catastrophic Losses Take Additional Toll

In addition to the losses from destructive agents considered in the mortality and growth impact estimates, there are losses from unpredictable events characterized by extraordinary severity and concentrated loss which are termed "catastrophic" timber destruction. Since 1900, 14 such events have been recognized and are enumerated in the section on protection in Chapter IV. Examples include the Tillamook burn of 1933 in Oregon, the New England hurricane of 1938, the more recent destructive outbreak of the Engelmann spruce beetle in Colorado, and the chestnut blight in the East. Total estimated losses from these events exceed 122 billion board feet, of which approximately 16 billion have been salvaged. Insects were responsible for 52 billion board feet, fire 32 billion, wind over 19 billion, and disease 18 billion. These total losses prorated over the first half of the century average about 2 billion board feet a year, but they are unpredictable as to locality or time. However, 75 percent of the loss occurred in the West.

With the passage of time such losses may become predictable on an average annual and nation-wide basis. But it is doubtful if they can be predicted accurately enough to be included in periodic estimates of mortality and growth impact for individual regions or States. An effort is made to account for such catastrophic losses by providing a margin when estimating needed growth.

FOREST TREE PLANTING

Because so much of the commercial forest land of the United States (115 million acres) is poorly stocked, or nonstocked, and because planting offers an effective way to restore some nonstocked lands to productivity, to improve stocking of poorly stocked land, and to shorten the lapse of time waiting for natural regeneration, an appraisal of the present status of forest planting and planting possibilities was made in connection with the Timber Resource Review.

These planting estimates summarized here are conservative because they do not include (1) planting in lieu of natural regeneration after cutting, or (2) inter-planting to improve stocking on poorly stocked lands. It is believed that planting for these purposes will become more common as the intensity of forestry increases in the United States. Therefore, total planting possibilities and needs may ultimately be significantly larger than the estimates in the current appraisal.

Estimates of plantable area and acceptable plantations have been developed. Briefly, plantable area includes lands on which the planting of forest trees is practical from a

physical or biological standpoint. Such lands need to be planted if they are to be restored to productivity within a reasonable time.

Acceptable plantations are defined as those which have, at the end of the fifth year after planting, 400 trees per acre for all Eastern species, 200 trees per acre for all Western species except Engelmann spruce and lodgepole pine for which the standard is 300.

The significance of planting possibilities is emphasized by the estimate that the plantable acreage which was included could be expected to yield an annual growth of 8 billion board feet after the trees reach merchantable sawtimber size. If this were achieved, the output from the plantable area would equal 17 percent of 1952 net growth of sawtimber. Such an addition to net growth would help substantially in raising growth to the levels needed to meet potential demand estimates.

One-tenth of Commercial Forest Land is Plantable Area

About 52 million acres of commercial forest land is classed as plantable area. This is 45 percent of the 115 million acres of poorly stocked (73 million acres) or nonstocked (42 million acres) commercial forest land. About 83 percent of total plantable area is in the East and is divided almost equally between the North and South. The remainder or 17 percent is in the West (table 47).

Table 47.—Status of planting on commercial forest land, by section, 1952

Section	Plantable area	Area planted	Area of acceptable plantations	Planting success[1]
	Million acres	*Million acres*	*Million acres*	*Percent*
North	21.4	3.8	2.7	71
South	21.9	2.3	2.0	85
West	8.6	.8	.5	75
United States	51.9	6.9	5.2	76

[1] Area of acceptable plantations as a percentage of area planted.

About 83 percent is in private ownership, 11 percent in Federal ownership, and 6 percent in other public ownership (table 48 and fig. 27).

Table 48.—Status of planting on commercial forest land by ownership class, 1952

Section	Plantable area	Area planted	Area of acceptable plantations	Planting success[1]
	Million acres	*Million acres*	*Million acres*	*Percent*
Private	43.0	3.4	2.5	74
Public:				
National forest	4.6	1.9	1.4	76
Other Federal	1.0	.2	.2	78
State and local	3.3	1.4	1.1	81
Total	8.9	3.5	2.7	78
All ownerships	51.9	6.9	5.2	75

[1] Area of acceptable plantations as a percentage of area planted.

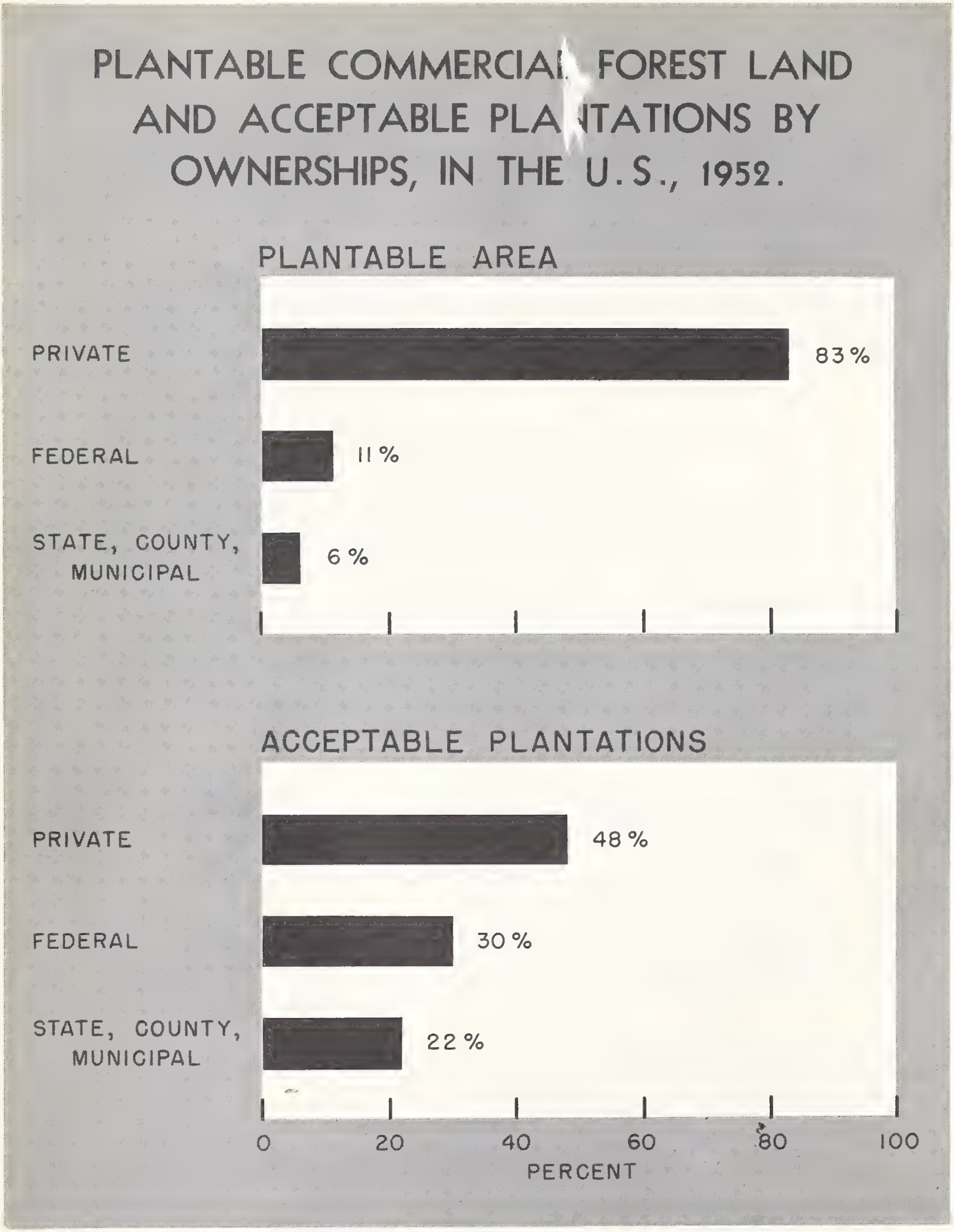


Figure 27

In addition to the 52 million acres of plantable commercial forest land, there are an estimated 5.4 million acres of plantable noncommercial forest land. Most of this is in the West about equally divided between public and private ownerships. About one-fifth of the plantable noncommercial area has primary values for watershed protection and the purpose of planting the remainder would be mainly for improvement of wildlife habitat.

Acceptable Plantations Equal 10 Percent of Plantable Area

The total area of acceptable forest plantations in the Continental United States is 5.2 million acres. This is 10 percent of the remaining plantable area of 52 million acres and about 1 percent of the total commercial forest land area (table 47). About half of the acceptable plantations are in the North, 40 percent in the South, and 10 percent in the West.

On an ownership basis, 48 percent of the acceptable plantations are privately owned, 30 percent are federally owned, and 22 percent are in State, county, and municipal ownership (table 48, and fig. 27).

Acceptable plantations have been related to total area planted in order to get some measure of planting success. On a national basis, about three-fourths of total area planted qualifies as acceptable plantations. This varies somewhat by sections of the country and by major ownership groups. The most successful planting has been in the South where 84 percent success has been achieved. State and other public ownerships show a greater planting success percentagewise than either Federal or private plantings which rate about the same.

Planting Trend is Upward

The annual rate of planting is distinctly upward, having increased between 5 and 6 times in the past quarter of a century (fig. 28). For example, an average of 68 thousand acres of acceptable plantations were established annually in 1926-29 in contrast to the annual rate of 388 thousand acres in 1950-52. Since then the rate has accelerated rapidly. Planting rates during the next 20 to 25 years are expected to increase still more, so that by 1985 possibly another 25 million acres will have been transferred to acceptable plantations. There are many reasons for this expected increase, including better machines for planting, increased interest in planting especially by industrial groups, and better nursery stock. To meet these expected increased planting rates, and also to allow for higher planting standards in the future, planting in lieu of natural regeneration, and interplanting on areas 10 percent or better stocked, will require an annual output of nursery stock of about one billion trees, which would be somewhat more than double the 1952 production of 462 million.

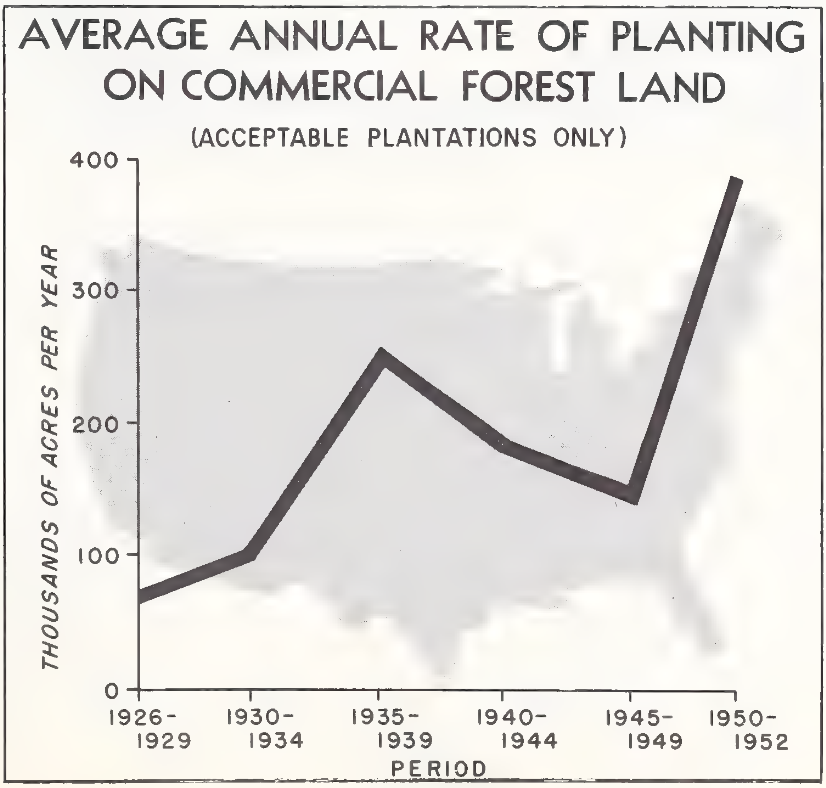


Figure 28

Despite increases in the planting rate during the past 25 years and expected additional increases in the future, it is important to recall that in 1952 only 400 thousand acres out of a plantable area of 52 million were actually planted, or less than 1 percent (fig. 29). Even if this rate were doubled, it would take many years to cover the plantable area, and would mean substantial areas of land lying idle for a long time.

There is still a big plantable area in the United States

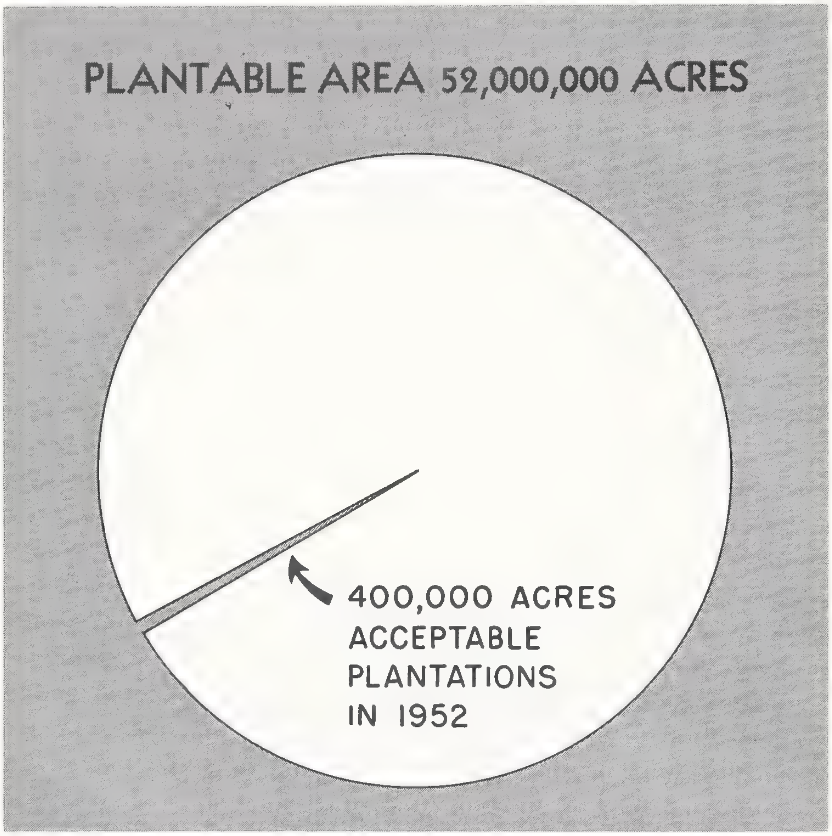


Figure 29

In summary, the planting situation boils down to: (1) about 50 million acres or one-tenth of commercial forest land needs planting; (2) acceptable plantations total about 5 million acres or one-tenth of the area in need of planting; and (3) although planting trends are distinctly upward, there remains a big planting job: completion of this job holds promise of adding substantially to future growth.

CONDITION OF RECENTLY CUT LANDS

It is generally recognized that the condition in which the forest is left after cutting greatly influences subsequent growth. From 2 to 4 percent of the commercial forest land has been cutover annually in recent years. Except for the cut that comes from the 50 million acres of old growth in the West, current output of forest products comes from previously cutover lands. All of the eastern commercial forests have been cutover at one time or another with the exception of a few residual remnants. It follows, therefore, that condition of the land and residual timber stand resulting from cutting is an important factor in both current and future growth.

The greatest utility of a survey of forest condition on recently cutover lands is the identification of areas by size and kind of ownership, locality, and forest type which are strong or weak from the standpoint of productivity and future growth prospects. The survey identifies those areas which are in average, better-than-average, or poorer-than-average conditions, and indicates where lie the possibilities for greatest improvement in future growth.

Productivity of recently cut forest lands as determined in the Timber Resource Review is based upon a detailed field sampling survey of cutover lands in all kinds of ownerships in all parts of the country. The field survey was a highly technical and complex job. It is described in detail in the section on condition of cutover lands in Chapter IV and Chapter IX which describes sampling standards and the criteria used for rating productivity.

State and industry foresters contributed a great deal not only in execution of the survey itself, but also in developing the individual productivity criteria for various forest types and localities. Over 40 percent of all cooperative assistance received in connection with the Timber Resource Review, or the equivalent of more than $215,000, was made available for the productivity survey. Field examiners were denied access to only six ownerships, aggregating 1.5 million acres.

This is the second nation-wide survey of this general character--the first being undertaken in 1945 by the Forest Service. There have been six other more localized surveys of this general character sponsored by industry, State, or Federal groups, all of which have differed in scope and design.

Results of this survey of recently cutover lands cannot be compared with the results of the cutting practices of the 1945 Reappraisal. At the outset there was a choice of doing the survey exactly the same way as in 1945 in order to get the best possible trend indications, or of making changes to take advantage of more recent experience and advances in technical knowledge. The latter choice was followed, recognizing at the time that it would sacrifice comparability and the possibility of identifying trends. Probably the least invalid of the various comparisons that might be made is to relate the proportion of recently cut lands in the high productivity class of the current survey with the combined proportions of "high order," "good" and possibly half of the "fair" practice levels of cutting in the Reappraisal. The Forest Service has made a careful study of possible comparisons but has drawn none, because it believes that any comparisons that might be made are highly questionable. There are many specific reasons for lack of comparability. These are discussed in Chapter IV.

Productivity Index--A New Concept is Appraising Forest Condition

Essential to an understanding of results of the survey of recently cut lands is a clear grasp of the "productivity index" which was used to classify recently cut lands into various groups. A rating system with indexes ranging from 1 to 100 was developed. This was based on consideration of several individual elements. An index rating of 100 for a recently cut area did not mean it was the best attainable. On the contrary, it only meant that forest condition, i.e., productivity of recently cut lands, was at a standard or level considered reasonably attainable for the particular locality, site and forest type under current and average operating situations. This is very important and is one of the main reasons why such a large area of recently-cut lands qualified for the upper level of productivity. An index of 100 is a higher standard than what might have been adopted as reasonable or practical several years ago; it is a lower standard than what might be reasonable or practical at some future time. The standards did not represent biological potentials of the land nor were they geared to growth needed to meet potential demand or requirements. Standards geared to either of these alternatives would have been much higher.

Unlike the 1945 survey this survey was not concerned with forest management practices. It omitted consideration of intent of ownership, existence of sustained-yield

policies, management plans, or planned use of silvicultural systems. Conditions on the ground were appraised as they were found regardless of whether they resulted from accident, a bountiful nature, or purposeful action of the owner. The survey covered practically all large-size private and public ownerships, and sampled the medium and small private ownerships. The objective was to obtain reasonably reliable data on a regional basis. The term "recently cut lands" relates to the fact that only cuttings made since 1947 were examined and in the case of two or more cuttings within that period only the most recent cutting was used.

Four main elements of productivity

The productivity index was designed to reflect the combined effect of four of the most important elements or factors which affect growth following cutting. These elements include: (1) existing stocking; (2) prospects for stocking where present stocking is deficient; (3) species composition; and (4) felling age or the age of trees or stands at the time the cutting occurred. In the field examination, each of these elements was expressed on a rating scale of 0 to 100 with the latter figure representing a standard of current attainability. The individual ratings were combined into a single over-all productivity index.

The standard for existing stocking referred simply to the number of crop trees or seedlings per acre adopted for a particular site or forest type.

Standards for prospective stocking recognized the likelihood of stocking and were considered only if stocking at the time of examination was deficient. In prospective stocking such factors were considered as seed sources, seed bed condition, the presence or absence of inhibiting vegetation, and topography.

Species composition referred to the kind of trees in the stand and included only commercial species. Trees were divided into two groups, (a) desirable, and (b) acceptable. If half the stand was in the desirable class, composition was considered up to standard. If all the trees were in the acceptable class, composition was considered half of standard. This recognized that acceptable trees have some value.

The standard for felling age was the age at which the trees involved would reach their maximum mean annual growth. If cut prior to that age, deductions from standard were made because the full growth potential of the stand was not realized. The felling age factor was applied only to clear-cutting and under rather restricted conditions as explained in Chapter IV.

The information on the various elements was obtained for each forest type which had been cutover wholly or in part since 1947 on each ownership which was examined. Each such cutover forest type per individual ownership was termed an "operating area." The criteria and the standards for the various elements were worked out regionally for each forest type and important locality or site. These are summarized in Chapter IX. The various elements were combined for each operating area into a productivity index by adding the ratings for existing and prospective stocking (but not to exceed an index of 100), multiplying their result by the composition factor, and then multiplying by the felling age factor (if applicable).

The productivity index scale of 0 to 100 was divided into three broad classes with adjective descriptions of each class as follows: 0-39, low; 40-69, medium; 70-100, high. Each individual operating area was assigned to one of three broad classes depending on the index rating for that particular area. It was then possible to show the proportion of total operating area by size or kind of ownership, or other grouping in each of the three broad productivity classes. This is the manner in which most of the results are presented in the subsequent description and tables. Thus, a statement that 65 percent of the operating area in the country was in the high-productivity class means that 65 percent (areawise) of the forest types on which there was recent cutting in the individual ownerships examined had a productivity index rating between 70 and 100 percent of what is considered reasonably attainable under current conditions. In other words, results are expressed

not in terms of productivity indices themselves, but in terms of proportion of operating area in the various broad productivity classes.

The standards could be higher

Much judgment necessarily enters into a procedure such as just described. There is judgment in the choice of the various elements of productivity, judgment in the development of the detailed criteria for particular localities for each element, and judgment in the system of compilation adopted. There may be some who will feel the standards were set too high. Others may feel that the standards were too low. The Forest Service believes the standards used were reasonable when it is borne in mind that the objective was to relate condition of cutover areas to a standard of what is currently attainable on the average under practical management, and that a 100-percent rating would mean only that forest conditions met or exceeded that standard.

There are numerous ways in which the productivity standards could be raised or lowered. For example, standards would be raised:

(1) If standards were geared to future requirements or needed growth.

(2) If a felling age higher than that of maximum mean annual growth were adopted in order to recognize the need for growing quality wood.

(3) If a felling age were recognized only for sawtimber (rather than for either growing stock and sawtimber) regardless of whether the cutting was for small or large products.

(4) If standards of composition had been higher.

(5) If higher standards of both existing and prospective stocking had been adopted. The stocking standards were frequently exceeded on properties under management.

The productivity ratings could have been grouped into more than three broad classes. Under the system adopted, operating areas with an index of 70 are grouped in the same class as those with an index of 95, and those with an index of 10 are grouped with those with an index of 30. The utilization of more classes would have resulted in greater selectivity. For example, if the limits of the upper class had been 80 to 100 rather than 70 to 100 the proportion of recently cut lands in that class would have been 48 instead of 65 percent.

Condition Varies by Ownership, Location, and Forest Type

In summarizing a survey as complex as this the problem can readily become one of statistical indigestion. For example, nearly 26 thousand individual ownerships were examined and each operating area of this group involved the individual examination of 4 to 30 plots, or 10 to 60 examination points. Furthermore, productivity as evaluated in this survey, varies according to such factors as size of ownership, kind of ownership, forest region or section, and forest type. To be of value it is necessary to examine the relationship of cutover forest condition to each of these various factors individually, and in combination.

Results are expressed in terms of the proportion of operating area in each of three broad productivity classes. Because the operating area of the entire country totalled 235 million acres at the time of this survey, or nearly one-half of the commercial forest land area of the United States, the grouping of operating areas into productivity classes is considered representative of the ownership, section or forest type in which the operating area occurred.

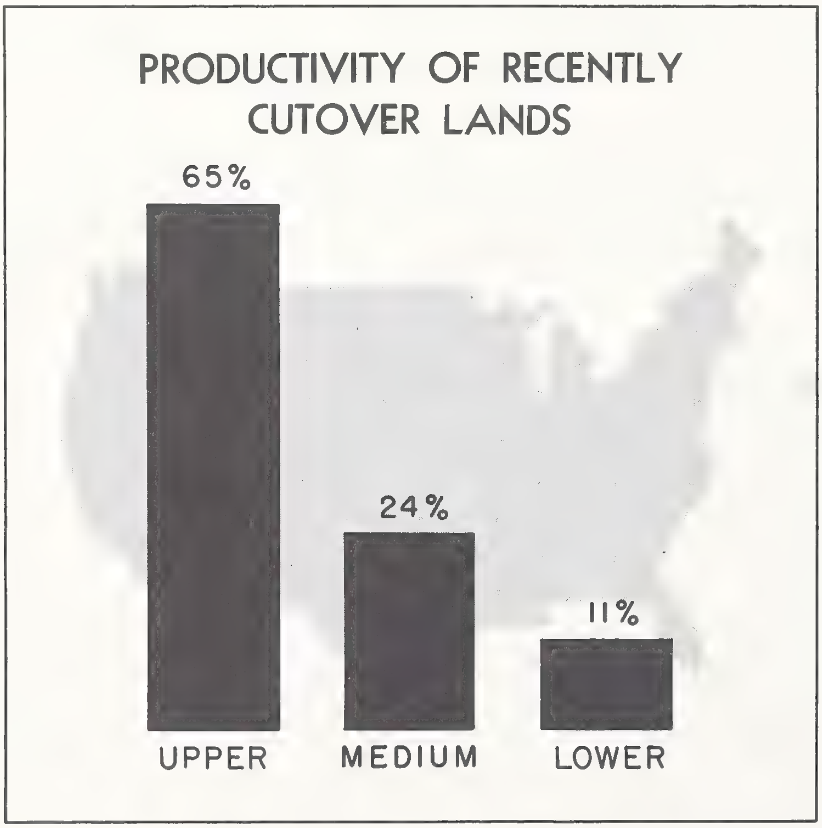
The overall result of the survey shows that 65 percent of the operating area of 235 million acres qualified for the upper productivity class, 24 percent for the medium class, and 11 percent in the lower class (table 49, fig. 30).

Table 49.--Productivity of recently cut commercial forest land in the United States and Coastal Alaska, 1953

Type of ownership	Commercial forest land	Operating area	Proportion of operating area by Productivity class		
			Upper	Medium	Lower
	Million acres	*Million acres*	*Percent*	*Percent*	*Percent*
Forest industries	62	[1] 44	77	19	4
Farm and other private	296	95	46	33	21
Public	131	96	80	17	3
All ownerships	489	235	65	24	11

[1] Excludes an unknown acreage of operating area on the 1.5 million acres of commercial forest land to which access was denied.

By major ownership groups it is apparent that public and forest industry ownerships have about the same proportion of their operating areas in the upper class with 80 and 77 percent, respectively. On the other hand, farm and "other" private ownerships, with about the same operating area as public ownerships, but much larger commercial forest land area, have only 46 percent in the upper productivity class. Over 50 percent of the farm and "other" private operating area is in the lower or medium classes.



Includes Coastal Alaska

Figure 30

Farm and "other" private ownerships in poorest condition

To the extent that the productivity indices truly reflect condition of recently cut lands there is conclusive evidence that the farm and "other" private (meaning private ownerships which are not farm and not forest industry) ownerships are most in need of improvement. For the country as a whole, only 41 percent of the operating area in farm ownerships qualified for the upper class, and for the "other" private ownerships, only 52 percent so qualified (table 50 and figure 31). Farm ownership has a larger proportion of operating area of medium productivity than does "other" private ownership, and both groups have about one-fifth of their operating area in the lower class. When it is recalled that a productivity index of 100 refers to only a standard that is reasonably attainable under average current conditions, it is not reassuring that the productivity index for more than half of the farm and "other" private ownerships, --which make up 60 percent of all commercial forest land, --was less than 70 percent of what is reasonably attainable.

Table 50.—Productivity[1] of recently cut commercial forest land by type of ownership and section, 1953

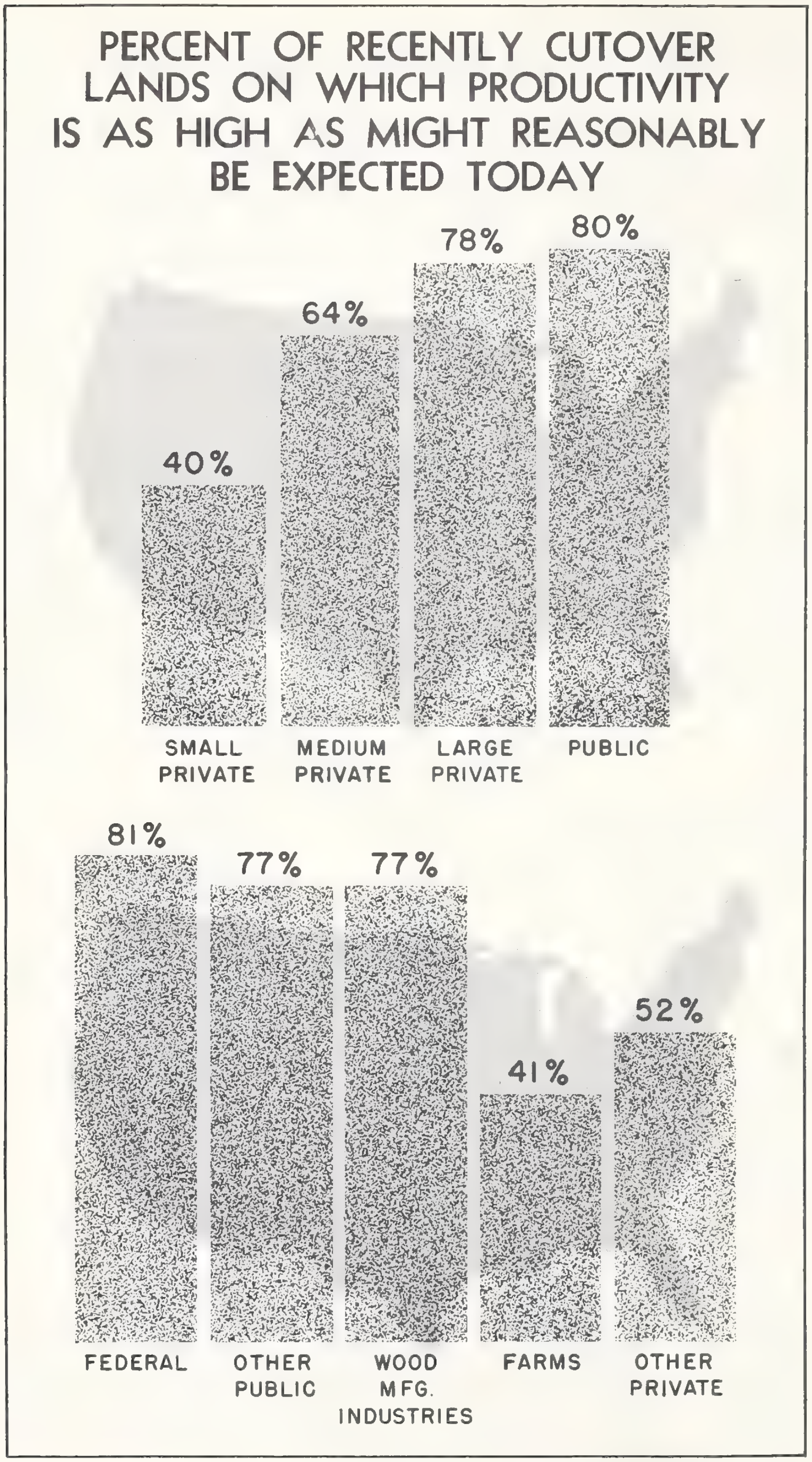
Ownership	All sections			North			South			West and Coastal Alaska		
	Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower
Private:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Farm	41	37	22	52	35	13	34	38	28	46	42	12
Forest industry:												
Lumber manufacturing	73	21	6	68	24	8	69	23	8	78	19	3
Pulp manufacturing	84	15	1	66	33	1	96	4	(2)	94	1	5
Other wood manufacturing	73	23	4	53	38	9	78	22	(2)	73	9	18
All forest industry	77	19	4	66	31	3	81	15	4	80	16	4
Other private	52	28	20	59	27	14	44	30	26	62	27	11
All private	56	29	15	58	31	11	51	29	20	68	25	7
Public:												
National forest	81	16	3	84	16	(2)	89	10	1	79	17	4
Bureau of Land Mgt.	80	15	5	—	100	—	100	—	—	83	12	5
Indian	74	25	1	94	4	2	100	—	—	70	29	1
Other Federal	80	16	4	56	31	13	83	14	3	85	15	—
State	77	18	5									
County	76	24	—	83	16	1	70	23	7	58	28	14
Municipal and local	93	6	1									
All public	80	17	3	83	16	1	86	12	2	78	18	4
All ownerships	65	24	11	67	26	7	55	27	18	75	20	5

[1] Expressed in percent of operating area in each productivity class.
[2] Less than 0.5.

Forest industry and public ownerships in much better condition

Forest industry averaged 77 percent of its operating area in the upper productivity class, and public ownerships averaged 80 percent in that class (table 50 and fig. 31). Condition of pulp industry lands with 84 percent in the upper class appeared significantly better than the lumber industry with 73 percent in that class. The lumber industry had 6 percent of its operating area in the lower class as against only 1 percent for the pulp industry. The results for the pulp industry were more favorable than for any other major ownership group, with the single exception of the municipal and local public ownerships which are small in area. All of the various public ownership groups have a large proportion of their operating areas in the upper productivity class.

Small ownerships continue to be the big problem



Includes Coastal Alaska

Figure 31

Small private ownerships in poorer condition than medium and large holdings

Regardless of the type of private ownership, there appears to be a distinct difference in cutover condition, depending on whether the ownership is small (under 5,000 acres) or larger than 5,000 acres. There is also a difference in cutover condition between the medium ownerships (5,000-50,000 acres) and the large ownerships (over 50,000 acres), although these differences are not so pronounced (table 51).

Table 51.—Proportion of recently cut private commercial forest land in the upper productivity class, 1953

Type of ownership	Size of ownership (acres)						
	All sizes	Large 50,000 and more	Medium 5,000 to 50,000	Small: Total: Less than 5,000	Small: 500 to 5,000	Small: 100 to 500	Small: Less than 100
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Farm	41	84	55	40	42	41	37
Forest industry:							
Lumber manufacturer	73	78	74	48	58	30	47
Pulp manufacturer	84	84	79	22	22	—	—
Other wood manufacturer	73	74	73	62	91	5	—
All forest industry	77	81	74	48	58	29	47
Other private	52	69	56	41	42	40	41
All private ownerships	56	78	64	40	44	40	38

For the large private ownerships of all types, nearly 80 percent of the recently cut lands qualify in the upper productivity class; this drops to 64 percent for the medium ownerships and to 40 percent for ownerships of less than 5,000 acres. The few large farm ownerships average about the same as the large forest industry ownerships and the "other" private ownerships of large size also rank fairly well. In contrast, small forest industry ownership qualifies only 48 percent in the upper class; and small farm and "other" private ownerships only 40 and 41 percent.

The small ownership group is broken down into still smaller size classes in table 51. It is difficult to draw any definite pattern other than the general inference that ownerships of less than 100 acres are in somewhat poorer condition than those from 500 to 5,000 acres. Thirty-eight percent of ownerships of less than 100 acres qualified for the upper productivity class, yet they comprise one-fourth of all commercial forest land. These very small ownerships are mainly in farms. Because of the large number of parcels involved, their importance from an acreage standpoint, and their relatively poor forest condition, these forest properties of less than 100 acres constitute an important part of the forest problem of the Nation.

Condition of recently cut land best in West, poorest in South

In the West, three-fourths of the recently cut lands qualified for the upper productivity class in contrast to two-thirds in the North, and slightly more than half in the South. The South had the largest percentage of recently-cut lands in the lower productivity class--18 percent in contrast to 5 percent for the West and 7 percent for the North (table 52). The variation in condition of recently cut lands in different sections of the country is explainable in large measure by the differing patterns of ownership. The West where cutover lands rate higher in productivity than other sections is dominated by public and the larger private ownerships, whereas the South with considerably lower productivity on cutover lands is dominated mainly by farm and "other" private ownership.

Table 52.--Productivity by sections

Section	Commercial forest land	Productivity class		
		Upper	Medium	Lower
	Million acres	*Percent*	*Percent*	*Percent*
North	174	67	26	7
South	193	55	27	18
West and Coastal Alaska	122	75	20	5
All sections	489	65	24	11

There are certain sectional variations within the same ownership group which are worth noting (table 50). For example, recently cut national forest lands in the South and the North have a higher proportion in the upper productivity class than do western national forests. On the other hand, State, county, and municipal lands show a considerably higher proportion of operating area in the upper class if they are located in the North (figure 32). In contrast to these two public ownership groups which show better forest condition in the North or South than in the West, the lumber industry shows just the reverse with 78 percent of its recently cut lands in the West qualifying for the upper class as against 68 and 69 percent for the North and the South. The pulp industry shows still a different pattern with 94 percent or more of its recently cut lands qualifying for the upper class in the South and the West, and 66 percent so qualifying in the North.

The farm and "other" private ownerships, which are in poorest condition for the country as a whole and are so important from an area standpoint, show considerable variation between different sections of the country. Farm ownerships in the South have the lowest rating with one-third of the recently cut lands in the upper class, and 28 percent in the lower class. In the North, over half of the farm-owned lands qualify for the upper class. The "other" private ownership likewise shows the poorest ratings for the South with 44 percent in the upper class.

Condition varies by forest type

Forest type is another of the variables affecting condition of recently cut lands.

In the East, for all ownerships combined, the aspen-birch and maple-beech-birch types show the highest proportion of recently cut lands in the upper productivity class. The oak-gum-cypress and elm-ash-cottonwood types, on the other hand, show the smallest proportion in the upper class. It does not follow, however, that the forest types which show relatively small amounts in the upper class necessarily show the largest proportion in the lower class. Those types which have the biggest proportions in the lower productivity classes in the East (and they all average about 20 percent) are the longleaf-slash pine, loblolly-shortleaf pine, and oak-pine types.

In the West, the western white pine and larch types are conspicuous by the relatively low proportions which qualify in the upper class. The forest condition of the western white pine type is related to the ecology of blister rust. In order to reduce subsequent direct blister rust control cost, it is necessary, following cutting, to provide sufficient cover to shade out the alternate hosts for the blister rust--currant andgooseberry plants. This shade is also unfavorable to establishment of western white pine. Consequently, because of the blister rust control problem, forest conditions favorable to prospective stocking with western white pine often are deliberately not created until some time after cutting. Western types which have the largest proportion of recently cut lands in the upper productivity class are the hemlock-Sitka spruce, lodgepole pine, and redwood types.

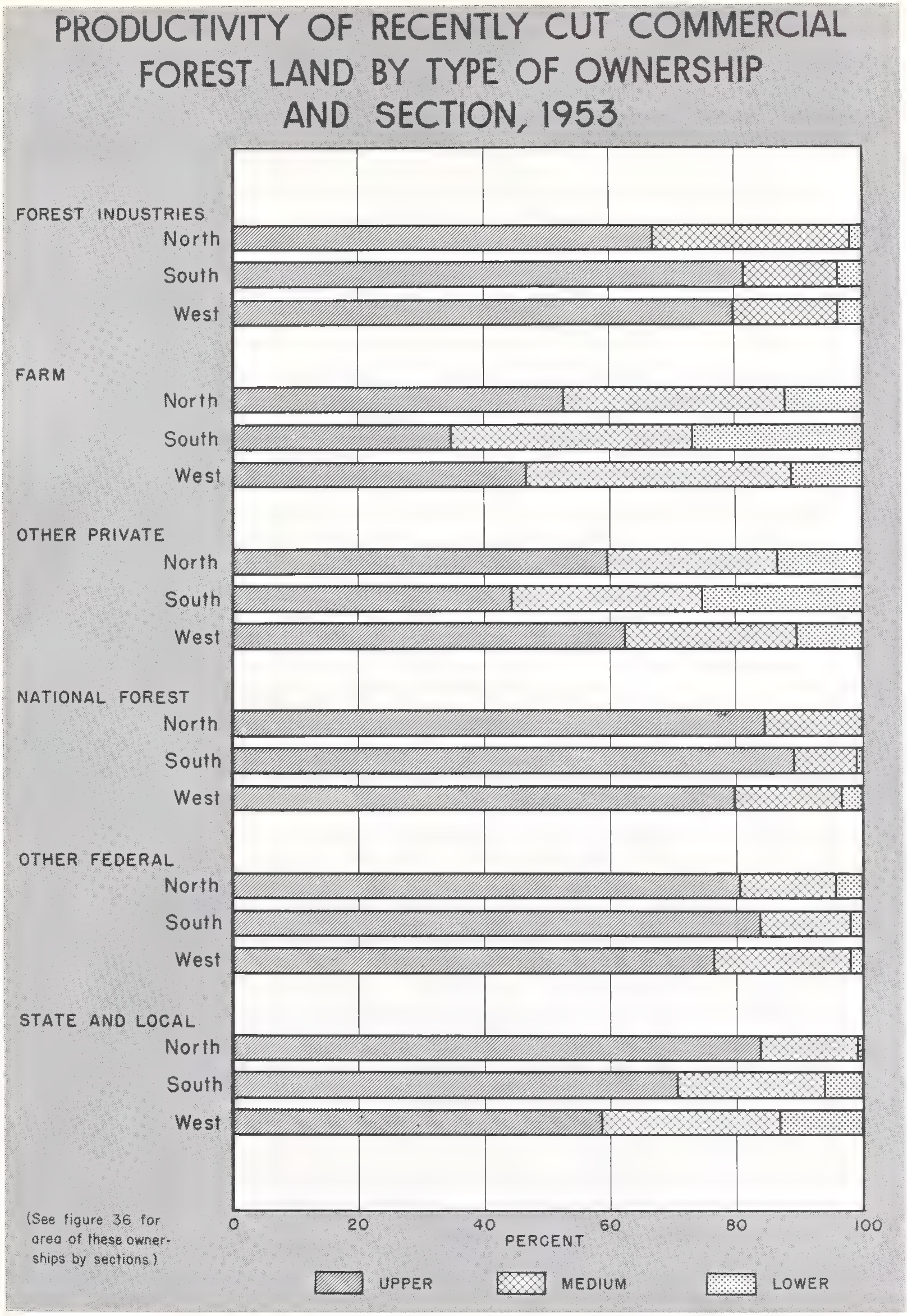

PRODUCTIVITY OF RECENTLY CUT COMMERCIAL FOREST LAND BY TYPE OF OWNERSHIP AND SECTION, 1953
FOREST INDUSTRIES
North
South
West
FARM
North
South
West
OTHER PRIVATE
North
South
West
NATIONAL FOREST
North
South
West
OTHER FEDERAL
North
South
West
STATE AND LOCAL
North
South
West
(See figure 36 for area of these ownerships by sections)
0
20
40
60
80
100
PERCENT
UPPER
MEDIUM
LOWER

Figure 32

Table 53.--Productivity of recently cut commercial forest land by forest type group, 1953

Forest type group	Productivity class		
	Upper	Medium	Lower
	Percent	*Percent*	*Percent*
Eastern type groups:			
White-red-jack pine	56	32	12
Spruce-fir	69	28	3
Longleaf-slash pine	62	19	19
Loblolly-shortleaf pine	55	24	21
Oak pine	59	23	18
Oak-hickory	54	35	11
Oak-gum-cypress	44	42	14
Elm-ash-cottonwood	40	49	11
Maple-beech-birch	76	20	4
Aspen-birch	84	14	2
All eastern types	60	26	14
Western type groups:			
Douglas-fir	77	19	4
Hemlock-Sitka spruce	90	9	1
Redwood	88	12	--
Ponderosa pine	73	23	4
Western white pine	20	48	32
Lodgepole pine	89	8	3
Larch	43	43	14
Fir-spruce	73	20	7
Western hardwood	75	25	--
All western types	75	20	5
All forest type groups	65	24	11

Stocking Deficiencies Most Significant Element in Productivity

Regardless of locality or ownership, substandard stocking proved to be the main factor in lowering the index of forest condition sufficiently to cause recently cut lands to drop out of the upper productivity class. Deficiencies in actual stocking were more pronounced in the South and West than in the North, and in small private ownerships than in large and medium private ownerships or in public ownerships (table 54). However, for the Nation as a whole, it is significant that over half of the recently cut lands would be ruled out of the upper productivity class on the basis of existing stocking alone.

Prospective stocking often partially offsets deficiencies in existing stocking. On individual ownerships, prospective stocking might offset lack of existing stocking entirely, but this was not general for any section of the country or for any major ownership group. Prospective stocking was most effective in the West and on the public and large and medium size private ownerships. Whereas over half of the recently cut areas in the Nation failed to qualify for the upper productivity class because of deficiencies in actual stocking, a little more than half of this area was returned to the upper class when allowance was made for prospective stocking (table 54). When both existing and prospective stocking were considered, about one-fourth of the recently cut lands still failed to qualify for the upper productivity class.

Table 54.—Relative effect of various elements in deriving upper productivity percentages

BY SECTION

Section or Class	Proportion of operating area deducted (-) or added (+) due to: Existing stocking	Prospective stocking	Composition	Felling age	Proportion of area in upper productivity class on basis of all elements
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
North	-40	+23	-8	-8	67
South	-62	+27	-3	-7	56
West and Coastal Alaska	-59	+37	-2	-1	75
All sections	-55	+29	-4	-5	65
BY OWNERSHIP CLASS					
Large and medium private	-49	+30	-4	-4	73
Small private	-62	+19	-6	-11	40
Public	-52	+35	-2	-1	80
All ownerships	-55	+29	-4	-5	65

Reasons for nonstocking were recorded for parts of the Pacific Northwest where certain additional data were obtained. In that region, the most important reasons for nonstocking appeared to be inhibiting vegetation--especially brush, presence of cull or noncommercial species, or a perennial sod cover--and inadequate seed source. Adverse site conditions, rodents, or other animals were judged to be of less importance.

In all regions, species composition and felling age had much less effect on forest condition than either existing or prospective stocking. However, composition and felling age were more important in the North than elsewhere and on small private than on other ownerships. On a national basis deficiencies in species composition were responsible for removing only 4 percent of the recently cut lands from the upper productivity class, and premature cutting had about the same effect.

Species composition was appraised only with respect to the proportion of desirable and acceptable species which stocked the area after cutting. If composition of the stand after cutting had been considered in relation to that before cutting, it is possible that composition would have been a more significant element. In Douglas-fir types of the Pacific Northwest, Douglas-fir tended to occupy a smaller proportion of the stand after cutting than before cutting. This was true of recently-cut lands in all ownerships except the national forests following clear cutting. Similarly, in the ponderosa pine type in the Northwest, ponderosa pine tended to make up a smaller proportion of the stand following cutting than before. These trends indicate that, in some types at least, the more preferred species are being partly replaced in the newer stands with less desirable species.

Contrasts in Forest Condition

With so many variables, it is difficult to isolate one particular combination that is characteristic of the best condition or of the poorest. In attempting to identify combina-

tions of variables representing relatively good conditions and those representing relatively poor conditions, it is necessary to consider type of ownership, size of ownership, geographic location, and forest type, all in relation to the proportion of recently cut lands in various productivity classes, the acreage involved, and number of ownerships.

An effort has been made to select several combinations of factors which represent both relatively good and relatively poor combinations from the standpoint of forest condition. In identifying relatively poor or weak areas, an effort was made to select those combinations with relatively large acreages but with small proportions of recently cut lands in the upper productivity class. For relatively good or strong areas, the effort was likewise made to identify large acreages and with high proportions in the upper productivity class. Both the strong and the weak areas are shown in figure 33. For both categories, some combinations of variables were chosen on a national basis and others were on a regional or sectional basis. For this reason there is overlap in the selections, but this is not important because the purpose was to illustrate various combinations of size, type and locality of ownership which are significant in terms of acreage, and which are outstanding with respect to either high or low proportions in the upper productivity class.

Conditions poorest on small private, farm, and "other" private ownerships

Small private ownerships, farm ownerships, and "other" private ownerships represent large acreages, large numbers of ownerships, but relatively small proportions in the upper productivity class (figure 33). The most significant problems in these categories are in the South.

On a national basis, small private ownerships with 265 million acres of commercial forest land and farm ownerships with 165 million acres each have only about 40 percent of their recently cut lands in the upper productivity class. The 4.5 million small private ownerships, of course, include a great many of the 3.4 million farm ownerships. Perhaps the outstanding combination of factors localized to a particular region are the small private ownerships of the South with 128 million acres in 1.8 million ownerships and only 34 percent of the recently cut lands in the upper productivity class (figure 34).

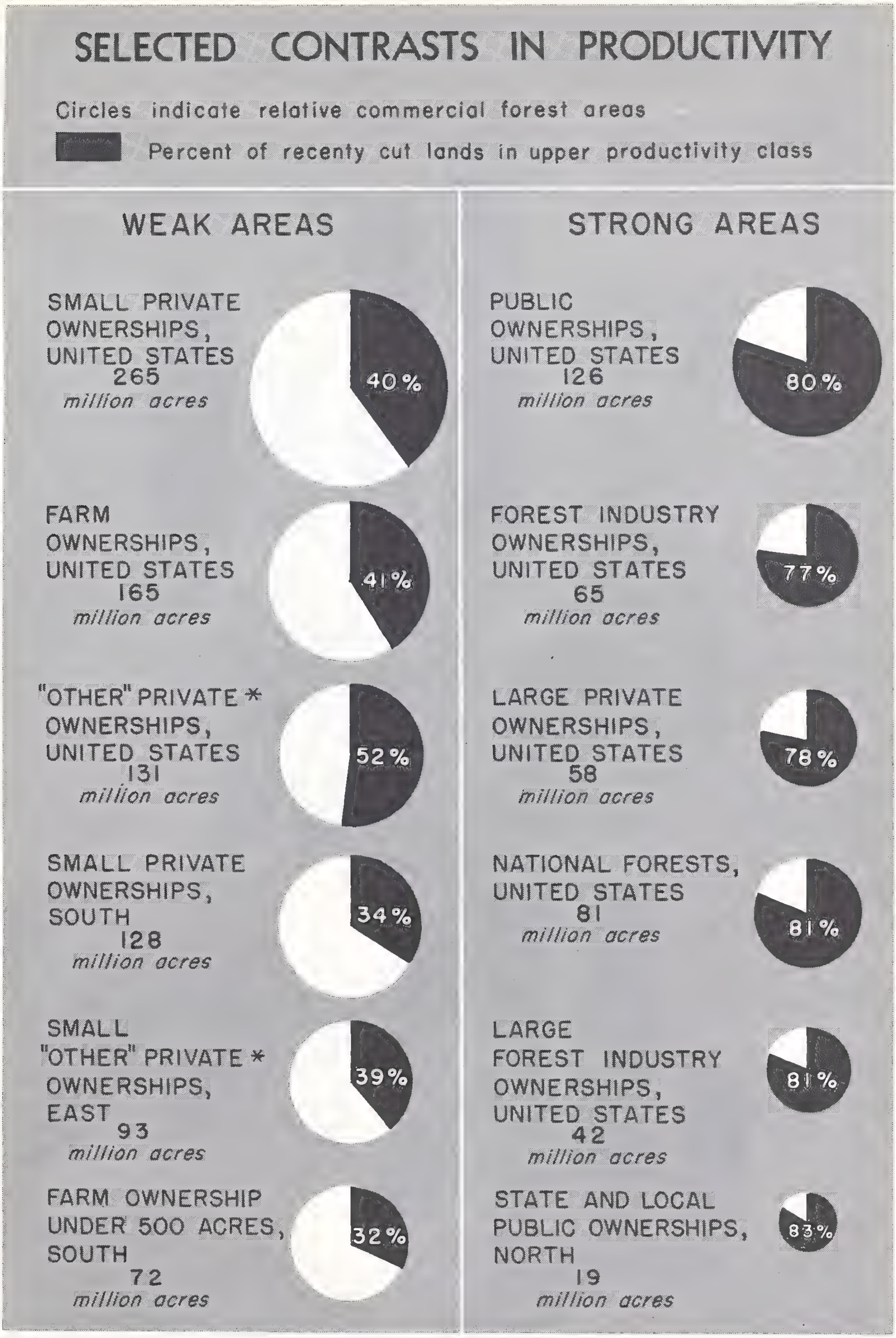
In addition, forest types enter into the picture. There are "weak" areas in the West in Douglas-fir, ponderosa pine and western white pine on small ownerships and in larch and western white pine in the larger private and public ownerships. Likewise major weak areas show up in the East on all types in small ownerships except maple-beech-birch and aspen-birch; and on larger private ownerships in oak-gum-cypress and oak-hickory types.

Conditions best on public, forest industry and large private ownerships

Public ownerships, forest industry, and large private ownerships generally are identifiable with relatively high proportions of the recently cut areas in the upper productivity class. There is considerable overlap between the forest industry and large private categories. It is noteworthy that the strong combinations with high proportions in the upper productivity class, as shown in figure 33, generally are not as large in acreage as the weak area combinations. The number of ownerships involved in forest industry or large private ownerships is a small fraction (less than 1 percent) of those in farm or small private ownerships.

Strong areas can be identified with respect to forest types in the same manner as weak areas in the preceding discussion. The southern pine types on public and medium and large private ownerships in the East and Douglas-fir and ponderosa pine types in these same ownerships in the West are pertinent examples.

The combinations illustrated in figures 33 and 34 are only a selected group. Others could be selected. The particular ones chosen demonstrate how the results of the survey



* Excluding farm and forest industry ownerships

Figure 33

Small ownerships in the South are the nub of the cutover land problem in the United States

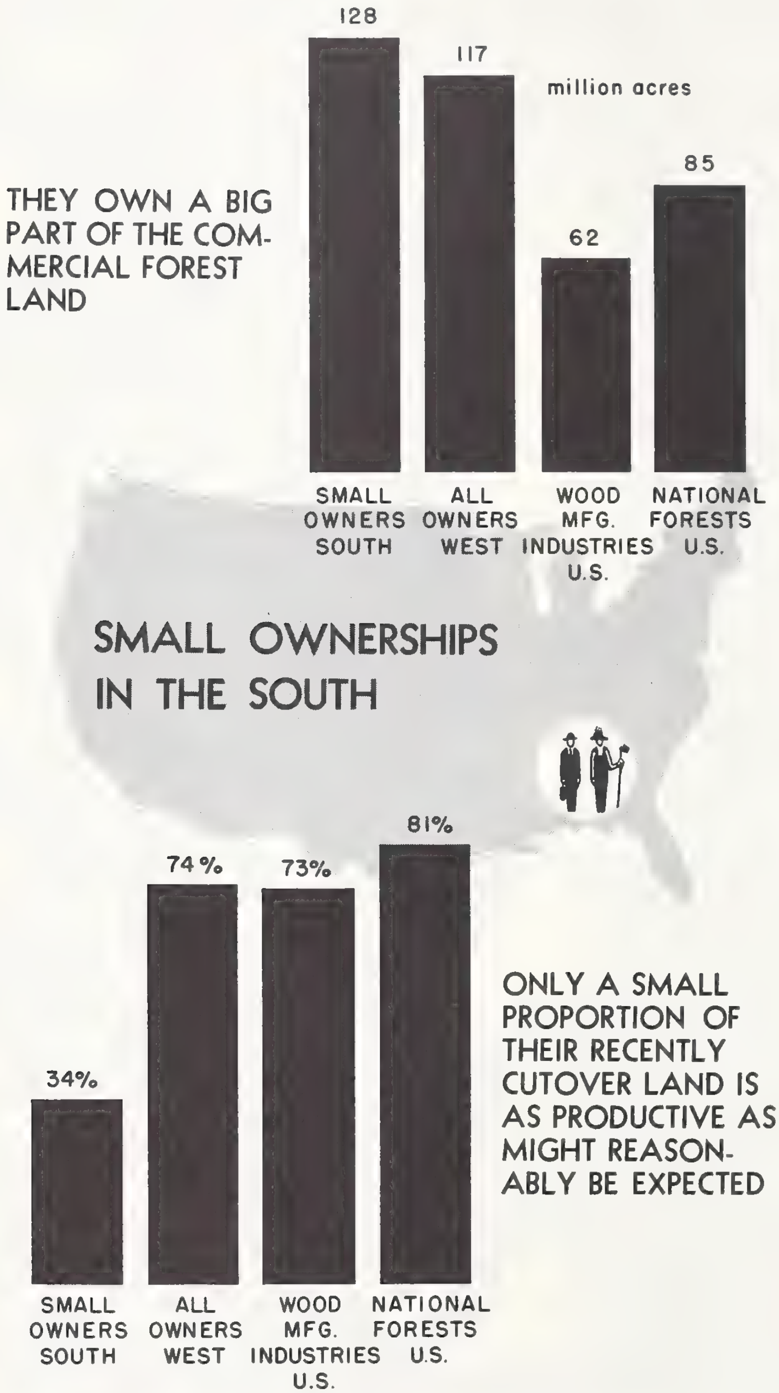


Figure 34

of cutover condition can be used to identify strength and weakness in the forest situation.

THE SIGNIFICANCE OF OWNERSHIP

What happens to the timber resources of the United States, both currently and in the future, depends on the wishes of individuals who control private timberland and on the policies of Government agencies which control publicly owned timberlands. Subject to such legal requirements as may be imposed upon him, the ultimate control of private timberlands is exercised by the owner. When an owner is disinterested or ill-informed, other groups such as timber buyers, loggers, or tenants exercise great influence and, in some instances, control for all practical purposes what happens to timber resources on a given property. But fundamentally, the ultimate control rests with the owner. Consequently, the identity of timberland owners, their characteristics, and the forces that motivate their decisions are extremely important in their effect on timber supplies.

For the above reasons, the Timber Resource Review has given special attention to ownership. Earlier sections of this Chapter contain some information on ownership of land and timber and on productivity of recently cut lands by kinds of ownership. The purpose of this section is to bring together that information in one place and to supplement it with additional information, especially on very small ownerships. Consequently, there is considerable repetition between this and earlier sections. This is believed justified in order to highlight in one place and in summary form the outstanding characteristics and significance of the four major ownership groups: forest industry, farm, "other" private, and public. Many of these characteristics are compared in table 55. Some readers may wish to pass over this summary and proceed directly to the subsequent section on Growth and Inventory Outlook.

Table 55.—Comparative characteristics of forest ownership in the United States and Coastal Alaska, 1953

Type of ownership	Number of ownerships		Commercial forest land		Live sawtimber				Growing stock	Proportion of recently cut land in upper productivity class
			Area	Average holding	Total	Softwood	Hardwood	Average stand		
	Thousands	*Percent*	*Percent*	*Acres*	*Percent*	*Percent*	*Percent*	*Bd. ft. per acre*	*Percent*	*Percent*
Private:										
Farm	3,383	75	34	49	15	9	41	1,900	20	41
Forest industries:										
Lumber manufacturer	21	1	7	1,630						73
Pulp manufacturer	(1)	(1)	5	146,390						84
Other wood manufacturer	2	(1)	1	2,200						73
Total, forest industries	23	1	13	2,660	37	35	47	4,000	39	77
"Other" private	1,104	24	26	119						52
Total, all private	4,510	100	73	79	52	44	88	3,000	59	56
Public:										
National forest	—	—	17	—	37	45	6	9,000	31	81
Indian	—	—	2	—	2	3	1	6,500	2	74
Bur. Land Management	—	—	1	—	4	5	(1)	12,700	3	80
Other Federal	—	—	1	—	1	(1)	1	2,000	1	80
Total, Federal	—	—	21	—	44	53	8	8,700	37	80
State	—	—	4	—	3	3	3	3,300	3	77
County	—	—	2	—						76
Municipal and local	—	—	(1)	—	1	(1)	1	1,500	1	93
Total, all public	—	—	27	—	48	56	12	7,500	41	80
All ownerships	—	—	100	—	100	100	100	4,200	100	65

[1] Less than 0.5

Forest Industry Ownerships

Few in number and small in total area

There are about 23 thousand forest industry ownerships in the United States, or less than one percent of the total number of private forest land ownerships. In numbers, this group is the smallest of the major ownership groups. About 21 thousand of these owners are engaged in the manufacture of lumber. This estimate should not be confused with the 60 thousand or so sawmills in the United States. Many sawmill operators do not own forest land, but purchase their logs by contract on the open market.

Commercial forest land owned by the forest industries represents 13 percent of the national total. It is a little more than a third as much forest land as owned by farmers, and about half as much as owned by "other" private ownerships or by the public agencies. Lumber manufacturers own 7 percent of all commercial forest land, and pulp manufacturers 5 percent.

Although the total forest land held by forest industry is small in relation to other major ownership groups, the average individual forest industry ownership is relatively large--2,660 acres. Lumber industry ownerships average 1,630 acres, and pulp industry ownerships nearly 150,000 acres. About 84 percent of the forest land owned by the lumber industry is in ownerships of 5,000 acres or larger, but the average for the lumber industry is considerably smaller because of the many small manufacturers whose individual acreage is in the smaller size classes. Ninety-four percent of the pulp industry ownership is in holdings of 50,000 acres and larger (table 56).

Table 56.--Proportion of commercial forest land in private ownership, 1953

Type of ownership	Size of holding (acres)					
	All sizes	50,000 and larger	5,000-50,000	500-5,000	100-500	Less than 100
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Farm	33.8	0.1	0.9	4.8	12.1	15.9
Forest industries:						
Lumber manufacture	7.1	3.8	2.2	0.6	0.4	0.1
Pulp manufacture	4.8	4.5	0.3	(1)	--	--
Other wood manufacture	0.9	0.4	0.5	(1)	(1)	(1)
Total, forest industries	12.8	8.7	3.0	0.6	0.4	0.1
Other private	26.7	3.2	3.2	4.1	7.5	8.7
Total, all private	73.3	12.0	7.1	9.5	20.0	24.7
Average size of holding (acres)	79	206,067	14,879	1,001	167	31

1 Less than 0.1 percent

Of the 58 million acres in ownerships of 50,000 acres and larger, nearly three-fourths is owned by the forest industries. The 283 large ownerships in this class average 206,000 acres. The seven owners of more than 1,000,000 acres apiece average 2,100,000 acres.

Over half (54 percent) of the commercial forest land owned by forest industry is in the South. The remainder is almost equally distributed between the North and the West (table 17 and fig. 35). The lumber industry ownership is concentrated in the South and West; pulp industry ownership in the South and the North (fig. 36).

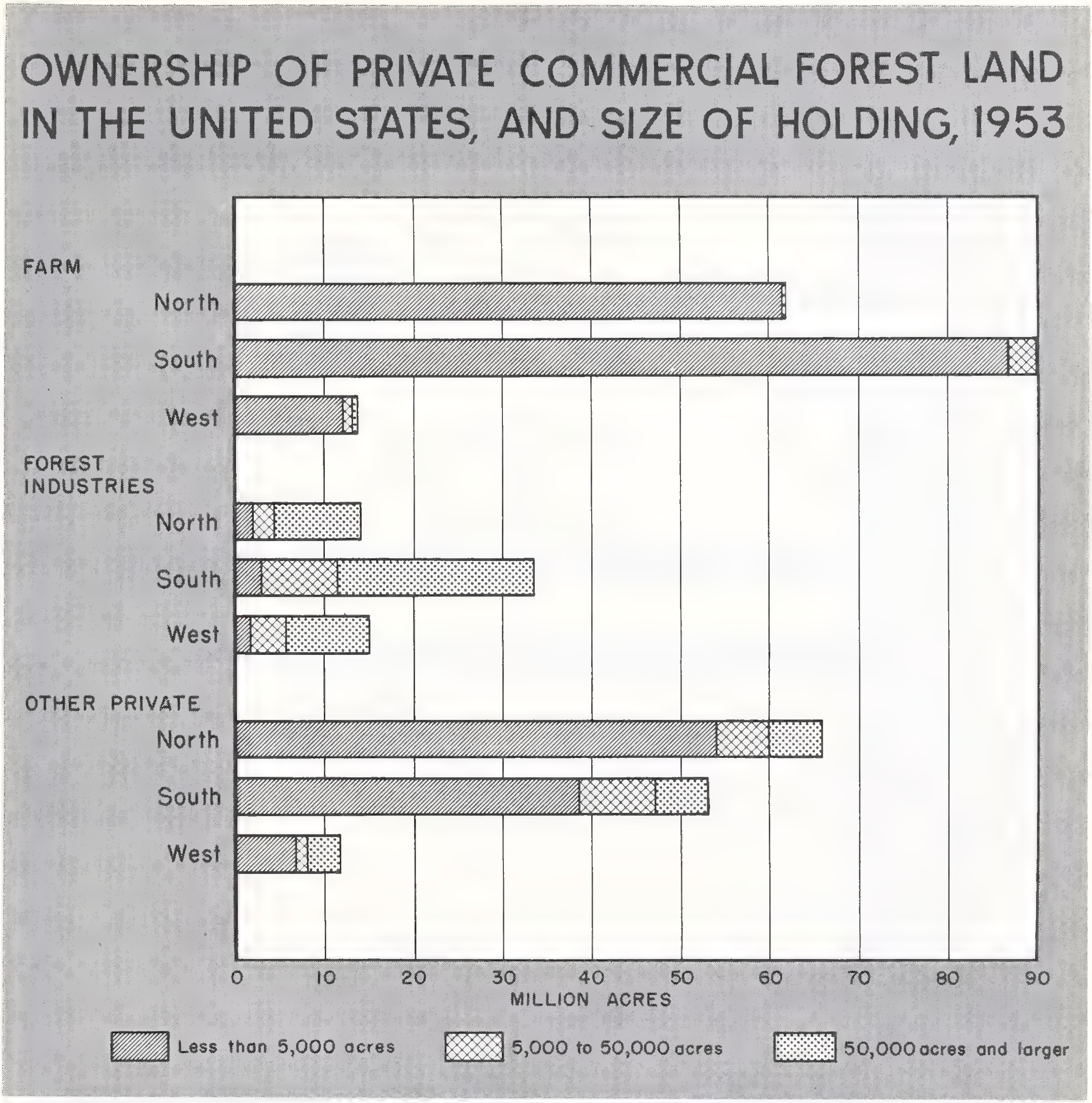


Figure 35

Timber volumes large in relation to acreage owned

Unfortunately, timber volumes for nonfarm private ownership were not broken down between the forest industry segment and "other" private ownerships. However, for those ownerships combined, the average stand per acre is 4,000 board feet of sawtimber. This is more than twice the average stand for farm ownerships, but less than half the average on public forests. The latter figure is due in part to the large volumes of old-growth timber which occur on some public land. It is probable that the average stand per acre in forest industry ownerships is higher than that in "other" private which more nearly resemble farm ownerships in other respects.

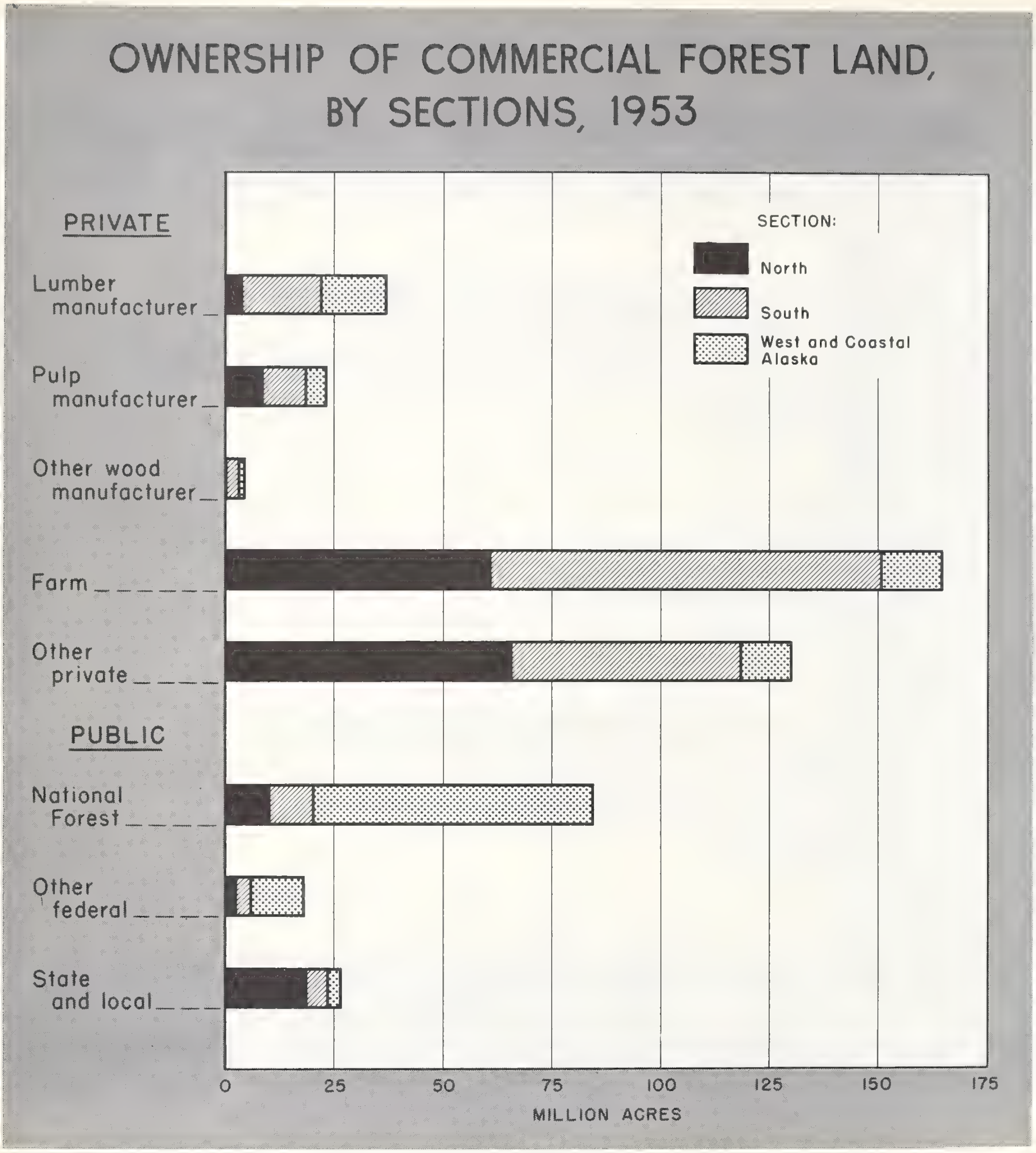


Figure 36

With respect to total U.S. softwood sawtimber volume, 35 percent is found in forest industry and other nonfarm private ownerships. This is a larger proportion than on any other ownership except the national forests. Considering the distribution of forest area between forest industries and "other" private, the concentration of industry ownership in the South, and the ownership by industry of some heavily timbered lands in the West, forest industries probably own from 15 to 25 percent of the Nation's softwood sawtimber. If this is a fair inference, it is apparent that forest industry ownerships are a more im-

portant factor in timber supply than would be indicated by the relative number of ownerships or the acreage owned.

About 77 percent of recently cut lands in forest industry ownership qualified in the upper productivity class. The pulp industry with an average of 84 percent in the upper class had a higher average percentage than any of the other private ownerships or the public ownerships, with the exception of municipal and locally owned lands which are small in total area.

Farm Ownerships

Large in number and total acreage

Of the 4.5 million private ownerships of commercial forest lands, 75 percent or 3.4 million are farm ownerships. Farm owners constitute by far the largest number of forest land owners.

One-third of all commercial forest land and close to half of all the privately owned commercial forest land is in farm ownerships. There is more commercial forest land in farms than in all public holdings combined. In simple terms this means that, for every three acres of commercial forest land in the United States, one acre is on a farm.

Like forest industry, more than half (54 percent) of the farm forest land occurs in the South. But whereas the remainder owned by forest industries is distributed about equally between West and North, 38 percent of farm ownership occurs in the North, and only 8 percent in the West (table 17). Thus, over nine-tenths of all farm ownership is in the East.

Most farmers own very small tracts

The average farm ownership is 49 acres. In contrast, forest industry ownerships average 2,660 acres, and the "other" private ownerships 119 acres.

With respect to size of forest holdings, practically all farm ownerships are less than 5,000 acres. Eighty-three percent of the farm-owned acreage is in tracts of less than 500 acres, and nearly half is in tracts of less than 100 acres (table 57).

Table 57.--Area and number of farm and "other" private ownerships, 1953

Size of forest holding (acres)	Farm				Other private			
	Number		Area		Number		Area	
	Thousands	*Cumulative percent*	*Million acres*	*Cumulative percent*[1]	*Thousands*	*Cumulative percent*	*Million acres*	*Cumulative percent*[1]
Less than 10[2]	671	20	4.2	1	125	11	.9	([3])
10 to 20	742	42	10.2	3	122	22	1.9	1
20 to 30	485	56	11.2	5	95	31	2.5	1
30 to 40	279	64	9.4	7	82	38	3.0	2
40 to 50	197	70	8.5	9	145	52	6.8	3
50 to 75	324	80	18.7	13	175	67	11.3	5
75 to 100	193	85	15.6	16	182	84	16.3	9
100 to 500	492	100	59.2	28	178	100	36.6	16
500 and larger			28.2	34			51.4	26
All ownerships	3,383	100	165.2	34	1,104	100	130.7	26

[1] Percent of total commercial forest area in the United States.
[2] East only.
[3] Less than 0.5.

From the standpoint of number of owners, it is significant that of the 3.4 million farmers owning forest land, over half own tracts of 30 acres or less, and two-thirds own tracts of 40 acres or less. Good forest management by the two million farm owners of less than 30 acres apiece would affect only 5 percent of the forest land and a correspondingly small proportion of timber supplies. More fruitful response in terms of timber growth might accrue from more intensified forestry effort on larger acreages owned by fewer individuals. On the other hand, growth and inventory needed to meet potential demands are so high as to suggest that not even 5 percent of the Nation's commercial forest land may be considered unimportant in meeting future timber needs.

Timber volumes small in relation to acreage owned

Sawtimber in farm ownerships averages 1,900 board feet per acre. This is lower than any other major type of ownership. The low stand per acre limits the importance of farm ownerships from the viewpoint of immediate timber supplies. It reflects past overcutting and lack of care, and the need for better management of farm forests in the future.

Although farm ownerships hold one-third of the commercial forest area, they support only 9 percent of the softwood sawtimber. This means that farm forest lands are not nearly as important in meeting current and near-future softwood requirements as might be expected in relation to area owned. On the other hand, farm ownerships support more than their proportional share of hardwood sawtimber and have more hardwood sawtimber than any other major ownership group. Considering both hardwoods and softwoods, farm ownerships have 15 percent of all sawtimber, in contrast to 34 percent of the forest area.

The 41 percent of recently cut farm timberlands in the upper productivity class is lower than for any other major ownership group, and only half as high as for pulp ownerships or the national forests. This should be of real concern to forest industries, independent loggers, and buyers who depend on timber from farm holdings, and who are in a position to exercise considerable influence on the condition in which farm forests are left after cutting.

"Other" Private Ownerships

By "other" private ownerships is meant privately owned forest land which is not in farm or forest industry ownership. It includes a miscellaneous group of owners embracing a large number of occupational pursuits and some nonforest industries such as railroads and mining. This group shows great diversity in owner characteristics such as occupation, tenure, residence on or off the property, and interest, knowledge, and intent with respect to forestry.

Localized studies of this ownership group have been made in New England, Tennessee, Mississippi, Arkansas, Louisiana, and California. However, they do not provide a basis for generalization as to the characteristics of these ownerships on a national basis. Furthermore, it is not known which of the various characteristics of "other" private owners are important in relation to forest condition. Among the more common occupations represented are business and professional people, wage and salary earners, housewives, and retired persons. Because this ownership group is so important in terms of number and in area of forest land controlled, there is a real need for further identification of its key characteristics in relation to forestry decisions.

Three-fourths of the area in small ownerships

The 1.1 million holdings in this group represent one-fourth of all private ownerships and contain one-fourth of all commercial forest land. The "other" private category includes twice the acreage owned by forest industries, is equal to that owned by all public agencies, and is exceeded only by farm ownerships. Half of the total area in this classification occurs in the North, with most of the remainder in the South (table 17).

It is more difficult to characterize the "other" private ownership classification according to size-class than either forest industry or farm ownerships, probably because of its heterogeneity. Whereas forest industry acreage is clearly concentrated in the medium and large holdings, and farm ownerships in the very small holdings, the "other" private ownerships are more widely distributed among classes. Nevertheless, three-fourths of the forest area in this category is in small ownerships (under 5,000 acres) and 60 percent is in holdings of less than 500 acres.

The average size of holding is 119 acres, which is over twice that of the average farm holding, but only a small fraction of the average industry holding. The probable explanation of this dispersion is that there are some large holdings in this group which lessen but do not overshadow the influence of the tremendous number of miscellaneous small holdings. It is evident from table 57 that one-half of the 1.1 million ownerships have less than 50 acres each, and account for only 3 percent of all commercial forest land.

Combining the farm and "other" private ownerships, 50 percent of the 4.5 million private ownerships have less than 30 acres of forest land apiece, and together they own only 6 percent of the commercial forest land (fig. 37).

The many private ownerships of less than 30 acres make up only a small fraction of all commercial forest land

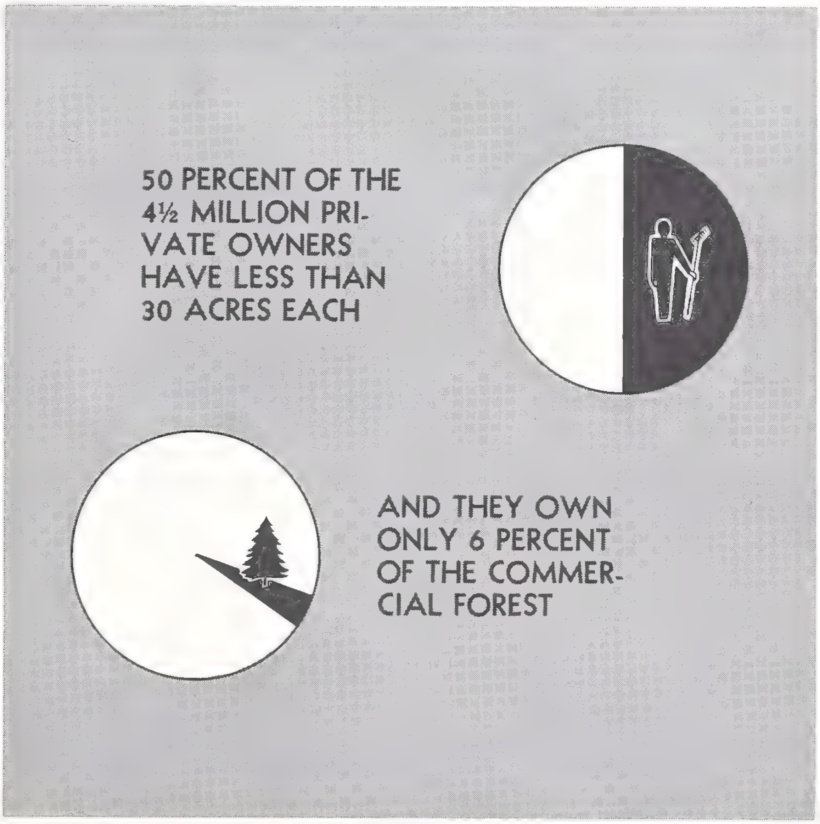


Figure 37

Includes Coastal Alaska

Although timber volumes were not determined separately for this group, it is believed that the "other" private ownerships are reasonably similar to farm ownerships in this regard. If so, the timber runs more heavily to hardwoods than to softwoods, and this premise is supported by the predominance of the ownership which occurs in the North--primarily a hardwood section. Because the "other" private ownerships exceed forest industry ownerships in area by 2 to 1, it can be assumed that the timber volumes held by this group are substantial inasmuch as the two ownerships together control 37 percent of all sawtimber.

About half of the recently cut lands in this ownership classification qualify for the upper productivity class. This is much below the average for forest industry ownership or for public ownerships, but is appreciably more than the average for farm ownership.

Public Ownerships

One-fourth of commercial forest land publicly owned

Public ownerships of commercial forest land comprise one-fourth of the national total--about the same in area as the "other" private ownerships, twice the area owned by forest industry, but significantly smaller than the area in farm ownerships. The principal public ownership, in terms of area and timber volume, is the national forests with 17 percent of the Nation's commercial forest land and 37 percent of the sawtimber volume.

The geographic location of publicly owned forest lands follows a distinctly different pattern than farm, forest industry, or "other" private. Public ownership is concentrated in the West due to the overriding influence of the national forests. On the other hand, a majority of the State, county, and municipally owned forest land occurs in the North. Of all publicly owned commercial forest land, 62 percent is in the West, 25 percent in the North, and only 13 percent in the South.

National forests mainly comprised of public domain

The great bulk of the national forests is made up of lands reserved from the public domain. Frequently overlooked is the fact that 85 percent of the national forests have never been in private ownership, as indicated by the following summary of national forest acreage by origin as of June 30, 1954:

Origin	Area (thousand acres)	Proportion (percent)
Reserved public domain	154,336	85.2
Purchases	18,369	10.1
Exchanges	6,591	3.6
Transfers from other Federal agencies	1,353	0.8
Donations	409	0.3
Total	181,058	100.0

National forest acreages have been reasonably stable in recent years. In fiscal years 1950-54, there was a net increase of 684,000 acres, comprised mainly of exchanges of land for land and some purchases. The rate of increase has been steadily downward since the late 1930's and in 1954 there was a net decrease in national forest land of 216,000 acres. These figures demonstrate that the national forests, which comprise the bulk of the publicly owned forest land, are not undergoing significant changes in area. The balance between private and publicly owned forest land is relatively stable at the present time.

Over half the softwood sawtimber is publicly owned

Of outstanding significance is the fact that 56 percent of the softwood sawtimber volume is in public ownership. Although the amount in forest industry ownership is not known, it is believed that public agencies and forest industry together own somewhere in the neighborhood of three-fourths of the Nation's softwood sawtimber. Forty-five percent is in the national forests.

Hardwood sawtimber is relatively unimportant on public ownerships--only 12 percent of the national total. The national forests with 17 percent of the forest area have only 6 percent of the hardwood sawtimber. On State forest lands, however, softwood and hardwood sawtimber occurs in about the same relative proportions.

Publicly owned forests average 7,500 board feet of sawtimber per acre, which is nearly twice the national average. This is due in part to the large residual volumes of old-growth timber on the national forests in parts of the West, and in part to the long-time forest management policies in effect on most publicly owned forest lands.

With respect to national forests alone, there is heavy concentration of both area and volumes in the West. Of the commercial forest land in the national forests, 72 percent occurs in the West, as does 84 percent of the sawtimber volume. The North and South each have 12 percent of the commercial forest land in the national forests, but together support only 5 percent of the sawtimber volume. Coastal Alaska, with 4 percent of the commercial forest area, currently has more than twice the sawtimber volume of all the national forests in the East. This situation will be changed in due time when the productivity of the eastern national forests is fully restored.

Key Conclusions

The above highlight comparisons show that the greatest advancements in forestry, the best conditions on recently cut lands, and the largest timber volumes occur on lands of the forest industries and public agencies. They also show that the farm and "other" private ownerships have the poorest cutover conditions, are largest in acreage, and largest in number of owners. Potentially, they are the largest also in timber volumes.

In summary, the key conclusions with respect to ownership appear to be:

1. The future forest situation of the United States lies with farmers and other non-forest industry private owners. They make up the heart of the forest problem.

2. Conversely, forest industry holdings and those of the public agencies, although they lead the way with respect to application of forestry, cannot supply the bulk of our long-range future timber supplies.

3. However, the principal source of softwood supplies, both currently and for some time in the future, is centered in the forest industries and the national forests.

GROWTH AND INVENTORY OUTLOOK

A major goal of American forestry is to grow enough timber to meet requirements. Only by doing this can the forest capital or inventory remain unimpaired and in condition to sustain requirements permanently.

Thus far, the two main parts of this report have dealt with: (1) the potential demand or requirements for timber products in 1975 and 2000; and (2) the supply of land and timber in 1953 with particular reference to such key factors as growth and utilization, protection, planting, productivity of recently cut lands, and ownership.

This third and concluding section discusses the outlook for future timber supplies. It is especially important to do this in a long-time proposition such as forestry where supply cannot be adjusted on a year-to-year basis, and where future supplies for any given time are determined largely by actions many years before.

This concluding section looks at future growth and inventory in relation to potential future demands in the following ways:

(1) The amount of growth is estimated that might be realized if all forest land were managed as well as the best managed is today. This serves as a bench mark against which to compare estimated future growth. This standard or bench mark is called "realizable" growth.

(2) Future requirements or potential future demands for timber are expressed in terms of the growth needed to meet those requirements. This is called "needed" growth.

(3) The quantity of standing timber needed to sustain the "needed" growth is also estimated and is called "needed" inventory.

(4) An estimate is made of the quantity of standing timber that might result in 1975 and 2000, if in the interim, (a) timber cut each year had gradually increased enough to meet the rising trend in potential demand, and (b) forestry advanced as indicated by recent trends. This is called "projected" inventory.

(5) The growth that could be expected in 1975 and 2000 from the "projected" inventory is also estimated and is called "projected" growth.

Thus the outlook for future timber supplies is approached from two basically different directions. The first is how much timber growth and inventory will be needed to meet future demands. The second is how much timber growth and inventory are we likely to have by the end of the century if rising demands are met each year until then. A comparison of how much is needed with how much we are likely to end up with, as well as with the bench mark of what is practically attainable under present conditions, indicates how easy or difficult it may be to meet future demands on a sustained basis.

The subsequent discussion is concise, and the subject is complex. Involved are two periods of estimation--1975 and 2000; two different levels of potential demand--upper and lower; two types of timber growth and volumes--growing stock and sawtimber; and three species groups--western species, eastern softwoods, and eastern hardwoods. These numerous factors contribute to the difficulty of presenting a complex subject in simple terms. No regional estimates are made because they would add to complexity and moreover the estimates are not considered sufficiently precise. The reader who wishes more detail should refer to Chapter VII.

REALIZABLE GROWTH

No serious effort has ever been made to estimate the biological potential of the Nation's commercial forest land. It is too difficult and too theoretical. A conservative estimate might be an annual growth of 50 billion cubic feet of growing stock and 200 billion board feet of sawtimber. Actually, it may be much more depending in part on one's concept of biological potential. No one actually knows. However, if such estimates are accepted merely as an indicator, it is evident that the biological potential is a great deal higher than the 1952 growth of 14 billion cubic feet of growing stock and 47 billion board feet of sawtimber.

Because the biological potential, whatever it may be, could never be attained from a practical standpoint, an effort was made to develop a more realistic concept of what might be practically attainable. Its purpose is to serve as a standard for comparison with needed and projected growth.

This concept has been termed "realizable growth." Actually, it is only a point on the growth ladder somewhat above present growth and considerably below the full biological potential. It is the growth that would be attained if the best present-day forestry practice in the various regions were extended to all commercial lands. It was developed locally, region by region, utilizing the best available technical information and judgment of experts familiar with local conditions.

The realizable growth estimate is about 100 billion board feet of sawtimber, 70 percent of which would be softwoods. It is a little more than double the 1952 growth of sawtimber. About 45 percent of the realizable growth would occur in the South, but the highest average per-acre growth would be in the West with 252 board feet per acre in contrast to 235 in the South and 142 in the North.

In terms of growing stock, realizable growth is 27.5 billion cubic feet and, as in the case of sawtimber, is twice the 1952 level. Realizable growth is summarized in table 59 by growing stock and sawtimber and by species groups.

NEEDED GROWTH AND INVENTORY

Needed growth and inventory are those levels needed to sustain potential demands permanently and also provide a margin for contingencies. Because two levels of potential demand were developed in the section on requirements, there are correspondingly two levels of needed growth and inventory. These are referred to as the upper and lower estimates.

The discussion of requirements concluded with the summarization of requirements for 1975 and 2000 by softwoods and hardwoods and for the upper and lower levels of demand (table 13). These potential demand or requirements estimates are the starting point for derivation of needed growth. Net imports are subtracted from requirements, leaving a residual termed "domestic output." Timber cut from growing stock is then derived from domestic output by making due allowance for improvements in utilization, the quantity of products cut from dead trees, cull trees, noncommercial forest land, and nonforest land. To the estimates of timber cut from growing stock is added a "margin" for contingencies. The result is the estimate of needed growth (table 58).

The margin for contingencies which is included in needed growth is 5 percent of the lower level timber cut for 1975, and 15 percent for 2000. One of the principal reasons why a margin is necessary is to provide for the catastrophic losses previously mentioned, and not included in the estimates of mortality. A margin is also necessary to allow for new and unforeseen uses of wood, national emergencies, and for underestimation. It is a cushion for safety. A margin of 2.8 billion board feet of sawtimber for 1975 seems reasonable when considered in relation to the average annual catastrophic loss of 2 billion board feet. The margin for 2000 is larger than that for 1975 because the historical

Table 58.--Projected requirements and needed growth of growing stock and live sawtimber, 1975 and 2000

Item	Requirements			Needed growth					
				Growing stock			Live sawtimber		
	Total round-wood	Less net imports	Domestic output	Timber cut	Plus margin	Total	Timber cut	Plus margin	Total
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd. ft.*	*Billion bd. ft.*	*Billion bd. ft.*
Lower level demand:									
1975:									
Softwood	10.0	1.2	8.8	8.4	.4	8.8	40.9	2.0	42.9
Hardwood	4.3	.1	4.2	4.0	.2	4.2	15.1	.8	15.9
Total	14.3	1.3	13.0	12.4	.6	13.0	56.0	2.8	58.8
2000:									
Softwood	12.5	1.2	11.3	10.3	1.5	11.8	49.6	7.4	57.0
Hardwood	5.5	.1	5.4	5.4	.8	6.2	19.4	2.9	22.3
Total	18.0	1.3	16.7	15.7	2.3	18.0	69.0	10.3	79.3
Upper level demand:									
1975:									
Softwood	11.1	1.2	9.9	9.6	.4	10.0	47.6	2.0	49.6
Hardwood	4.7	.1	4.6	4.4	.2	4.6	17.8	.8	18.6
Total	15.8	1.3	14.5	14.0	.6	14.6	65.4	2.8	68.2
2000:									
Softwood	15.2	1.2	14.0	13.0	1.5	14.5	68.4	7.4	75.8
Hardwood	6.8	.1	6.7	6.8	.8	7.6	26.7	2.9	29.6
Total	22.0	1.3	20.7	19.8	2.3	22.1	95.1	10.3	105.4

tendency is for estimates of future potential demand to underrun actual consumption, and the additional time contributes to greater uncertainty.

Needed Growth Much Larger Than Present Growth

Lower estimates

Needed growth to meet the lower level of potential demand for sawtimber in 1975 and 2000 will be 59 and 79 billion board feet, respectively. These are increases of 24 percent and 67 percent above the 1952 level of 47 billion board feet (table 59 and fig. 38).

Table 59.--Timber growth, 1952, realizable growth, needed growth, and projected growth

Item	Growing stock				Live sawtimber			
	Total	Eastern hardwood	Eastern softwood	Western species	Total	Eastern hardwood	Eastern softwood	Western species
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd. ft.*	*Billion bd. ft.*	*Billion bd. ft.*	*Billion bd. ft.*
Net annual growth, 1952	14.3	7.1	4.4	2.8	47.4	19.1	17.0	11.3
Realizable growth	27.5	10.2	9.7	7.6	100.7	30.5	39.6	30.6
Needed growth:								
Lower level demand:								
1975	13.0	4.1	5.0	3.9	58.8	15.6	24.4	18.8
2000	18.0	6.0	6.8	5.2	79.3	22.0	32.3	25.0
Upper level demand:								
1975	14.6	4.5	5.7	4.4	68.2	18.3	28.2	21.7
2000	22.1	7.4	8.3	6.4	105.4	29.1	43.1	33.2
Projected growth:								
Lower level demand:								
1975	18.2	9.1	5.4	3.7	61.1	24.1	20.7	16.3
2000	19.1	9.4	5.5	4.2	66.7	25.6	23.0	18.1
Upper level demand:								
1975	16.9	8.7	4.6	3.6	58.6	22.6	20.1	15.9
2000	12.2	7.9	.6	3.7	25.2	12.2	--	13.0

Figure 38

In cubic feet of growing stock, the 1952 level is sufficiently high to meet needed growth for 1975, but a 26 percent increase would be needed to attain the needed growth level for 2000.

The needed increase for western species under the lower level demand is 121 percent by 2000. This has little significance because so much of the western commercial forest land is occupied by old-growth timber with relatively little net growth. More significant is the 90 percent increase in growth needed for eastern softwoods. For eastern hardwoods the needed increase is only 15 percent (table 60). If needed growth is to be properly balanced, both eastern softwoods and western species must have significantly greater proportions of total growth than they do at the present time, and eastern hardwoods correspondingly less.

Table 60.--Relation of needed growth of sawtimber to 1952 growth

Species group	1952 sawtimber growth		Change in growth needed by 2000	
			Lower level demand	Upper level demand
	Billion bd. ft.	*Percent of total*	*Percent change*	*Percent change*
Eastern hardwoods	19.1	40	+15	+52
Eastern softwoods	17.0	36	+90	+154
Western species	11.3	24	+121	+194
All species	47.4	100	+67	+122

In considering these increases in needed growth, it is important to bear in mind that the lower level demand would mean a relative decline in the use of wood, a decrease in per capita consumption of lumber from present-day levels, and an increase in the real price of timber products. Thus, these increases in growth are needed even with wood gradually assuming a less important role in the national economy.

Upper estimates

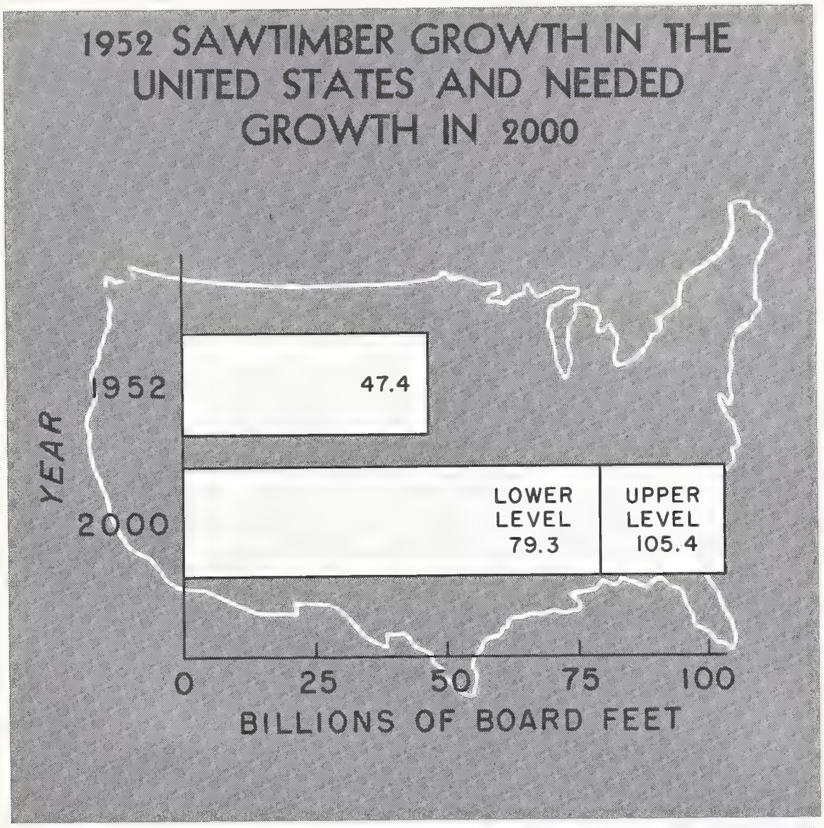
To meet the upper level of potential demand--which assumes that wood will hold its present place in the national economy--the board-foot growth of sawtimber must increase to 68 and 105 billion board feet in 1975 and 2000, respectively (fig. 38 and fig. 39). These would mean increases of 44 and 122 percent above 1952 levels.

Cubic feet of growing stock would need to increase 2 percent and 55 percent to meet the 1975 and 2000 upper level demands.

Eastern hardwood sawtimber growth would need to increase 52 percent by 2000, eastern softwoods 154 percent, and western species 194 percent. The needed board-foot growth in the year 2000 to satisfy upper level demands of 105 billion board feet is slightly greater than the estimate of realizable growth--101 billion board feet (fig. 40). Likewise, the estimates for eastern softwoods and western species are slightly above realizable growth estimates for those groups (table 59).

Such differences do not mean that the needed growth is unattainable. They do mean that, if these levels of needed growth are to be attained, the objectives of timber growers must involve an intensity of forestry not now achieved in this country, even under the best of present practices. The relationships between realizable growth and the upper level estimates of needed growth offer some indication of the challenge that is facing the Nation to more effectively utilize the productivity of its forest land.

Present growth is low in relation to long-range timber product needs



Includes Coastal Alaska

Figure 39

Needed Inventory One-third Greater Than in 1953

The changes needed in standing timber inventories in order to sustain the needed growth are not nearly so pronounced in relation to present levels as is needed growth. Although little change is indicated to meet lower level demands, about a one-third increase in sawtimber inventory would be needed to sustain the upper level.

The inventory needed in 2000 to sustain growth necessary to satisfy the lower level of potential demand will be 8 percent less than the 1953 inventory of sawtimber, but this over-all estimate camouflages important inventory changes needed in species groups. For example, there must be a 147 percent increase in eastern softwood inventory to meet the lower level needed growth estimate for sawtimber in 2000. In contrast, the sawtimber inventory of western species by 2000 could be 45 percent less than the existing inventory of western sawtimber and still produce the needed growth (table 61 and fig. 41).

Wood needs of the future will require effective use of the commercial forest land in the United States

Includes Coastal Alaska

Figure 40

Table 61.--Relation of needed sawtimber inventory to 1953 inventory

Species group	1953 sawtimber volume		Change in volume needed by 2000: Lower level demand	Change in volume needed by 2000: Upper level demand
	Billion bd. ft.	*Percent of total*	*Percent change*	*Percent change*
Eastern hardwoods----------------	381	18	+32	+102
Eastern softwoods----------------	242	12	+147	+301
Western species------------------	1,434	70	-45	-26
All species--------------------	2,057	100	-8	+36

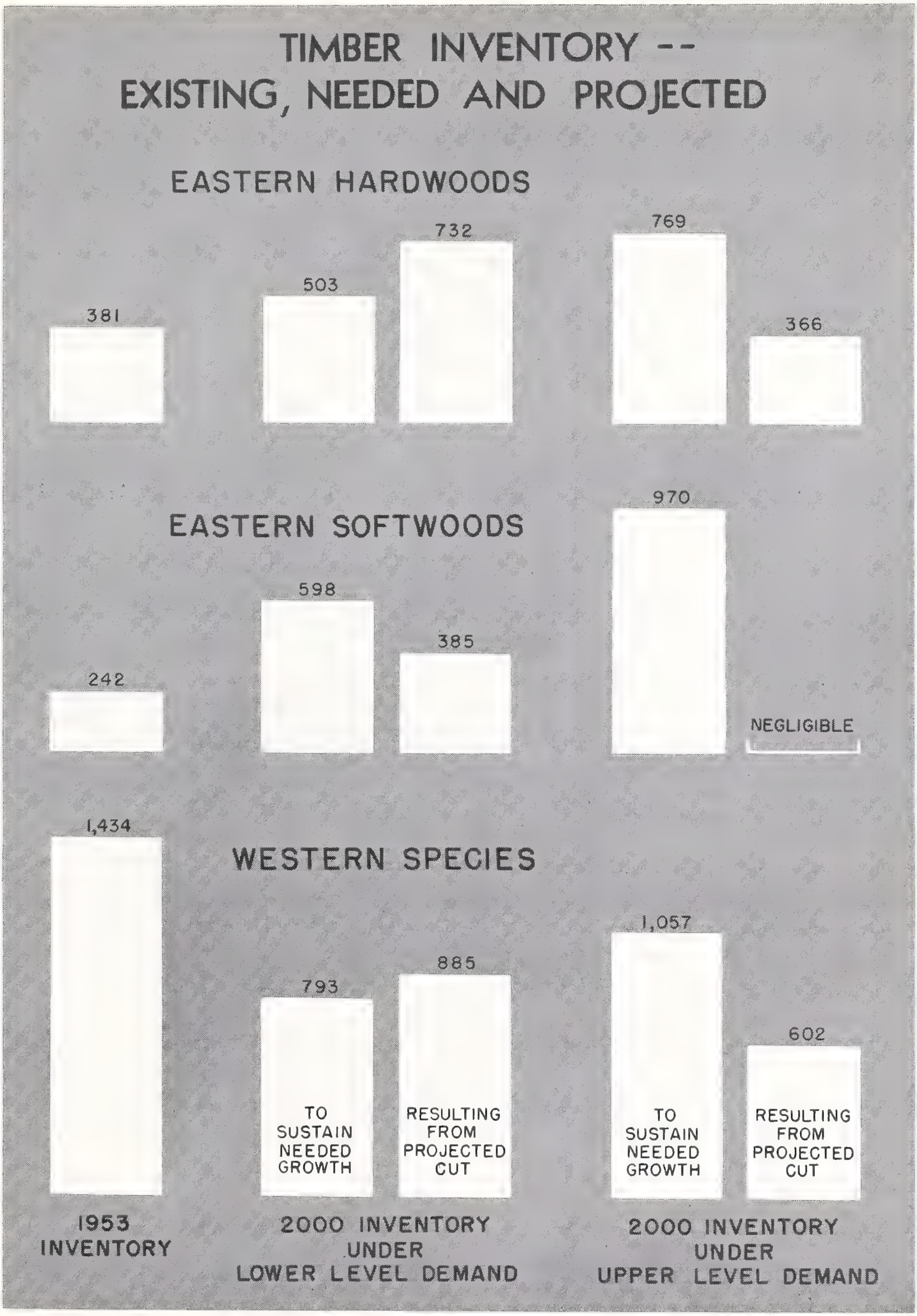

TIMBER INVENTORY --
EXISTING, NEEDED AND PROJECTED
EASTERN HARDWOODS
381
503
732
769
366
EASTERN SOFTWOODS
242
598
385
970
NEGLIGIBLE
WESTERN SPECIES
1,434
793
885
1,057
602
TO SUSTAIN NEEDED GROWTH
RESULTING FROM PROJECTED CUT
TO SUSTAIN NEEDED GROWTH
RESULTING FROM PROJECTED CUT
1953 INVENTORY
2000 INVENTORY UNDER LOWER LEVEL DEMAND
2000 INVENTORY UNDER UPPER LEVEL DEMAND

Figure 41

In terms of growing stock, the over-all inventory for the lower level estimate in 2000 can be slightly less than the 1953 inventory, but a doubling of eastern softwood growing stock is needed (table 62).

Table 62.--Timber volume, 1953, needed inventory, and projected inventory

Item	Growing stock				Live sawtimber			
	Total	Eastern hardwood	Eastern softwood	Western species	Total	Eastern hardwood	Eastern softwood	Western species
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd. ft.*	*Billion bd. ft.*	*Billion bd. ft.*	*Billion bd. ft.*
Inventory, 1953	517	151	74	292	2,057	381	242	1,434
Needed inventory:								
Lower level demand:								
1975	372	104	110	158	1,404	358	449	597
2000	511	152	147	212	1,894	503	598	793
Upper level demand:								
1975	416	114	124	178	1,808	482	635	691
2000	627	186	181	260	2,796	769	970	1,057
Projected inventory:								
Lower level demand:								
1975	604	241	96	267	2,041	542	310	1,189
2000	709	357	116	236	2,002	732	385	885
Upper level demand:								
1975	573	230	82	261	1,934	498	292	1,144
2000	499	289	7	203	968	366	--	602

Significant changes in proportion of total volume represented by different species groups are also indicated. Whereas eastern softwoods in 1953 accounted for only 12 percent of the sawtimber inventory, this would rise to about one-third by 2000. Also western species would drop from about 70 percent of the sawtimber inventory in 1953 to about 40 percent by the end of the century.

In terms of upper level demand, inventory of sawtimber would need to increase 36 percent above 1953 levels (table 61). For proper distribution among species groups, this would mean a doubling of hardwood sawtimber inventory, and a quadrupling of eastern softwood inventory. Western species would be reduced 26 percent from present relatively high levels. These estimates of needed sawtimber inventory in 2000 to meet the upper level of potential demand are the real inventory targets.

PROJECTED GROWTH AND INVENTORY

In the preceding paragraphs, estimates were developed of the timber growth and inventory needed to meet future demands. The purpose of this section is to estimate projected growth and inventory and compare them with needed growth and inventory.

Projected growth and inventory are the quantities that might result in 1975 and 2000 assuming that (1) annual timber cut would climb steadily from 1952 to meet the 1975 and 2000 timber demands plus margin, and (2) recent trends in forestry will continue so that by 1975 and 2000 forestry will be more widespread and intensive than in 1952. One-third of sawtimber volume and a still larger proportion of growth in 2000 is attributed to assumed progress in forestry as described in Chapter VII. If prospective growth and inventory had been developed against the same potential demand levels, but assuming only continuation of present levels of forestry, the results would be distinctly disheartening.

Lower Level Demands May Be Met Reasonably Well for Some Time

Projected sawtimber growth will increase slowly under the lower level demand assumptions from 47 billion board feet in 1952 to 67 billion in 2000. The projected growth of western species as well as both eastern softwoods and hardwoods will be some-

what above 1952 levels. Similarly, the projected growth of growing stock in 2000 will be 19 billion cubic feet in contrast to the 1952 level of 14 billion.

Projected sawtimber inventory in 2000 is estimated at 2,002 billion board feet or about the same as in 1953. There would be substantial increases in both eastern hardwoods and eastern softwoods which would be offset by a decrease in the inventory of western species. The projected growing stock inventory in 2000 of 709 billion cubic feet likewise reflects increases in eastern species and some decrease in western species in relation to 1953.

The projected growth and inventory of sawtimber in 2000 is summarized:

	1952-53 (billion bd. ft.)	2000 Needed (billion bd. ft.)	2000 Projected (billion bd. ft.)
Growth-------------	47	79	67
Inventory-----------	2,057	1,894	2,002

However, the above comparisons of projected growth and inventory with 1952 or 1953 levels are of much less significance than the relation between what there should be (needed growth and inventory) and what may be expected (projected growth and inventory). Such relations are summarized in table 63 for both sawtimber and growing stock.

Table 63.--Relation between projected growth and inventory and needed growth and inventory, 2000

LIVE SAWTIMBER

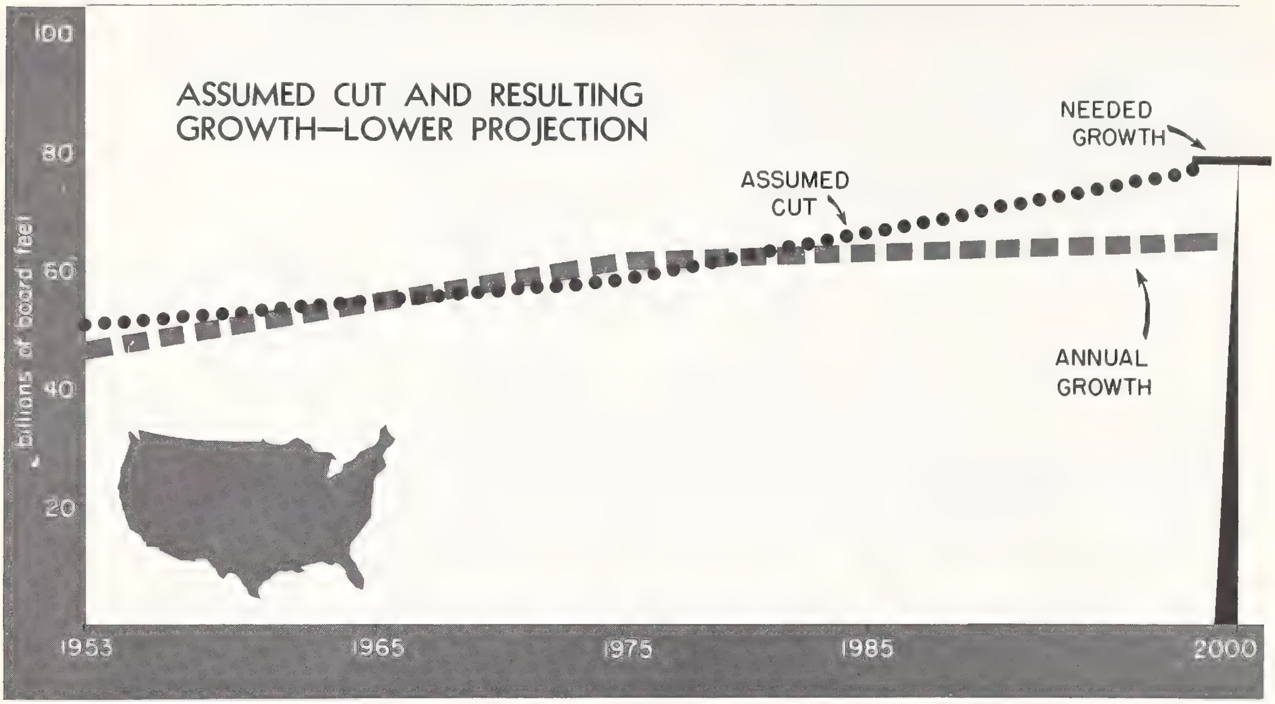
Item	Lower level demand		Upper level demand	
	Projected growth in relation to needed growth	Projected inventory in relation to needed inventory	Projected growth in relation to needed growth	Projected inventory in relation to needed inventory
	Percent	*Percent*	*Percent*	*Percent*
Eastern hardwoods--	+16	+46	-58	-52
Eastern softwoods--	-29	-36	Negl.	Negl.
Western species----	-28	+12	-61	-43
All species------	-16	+6	-76	-65

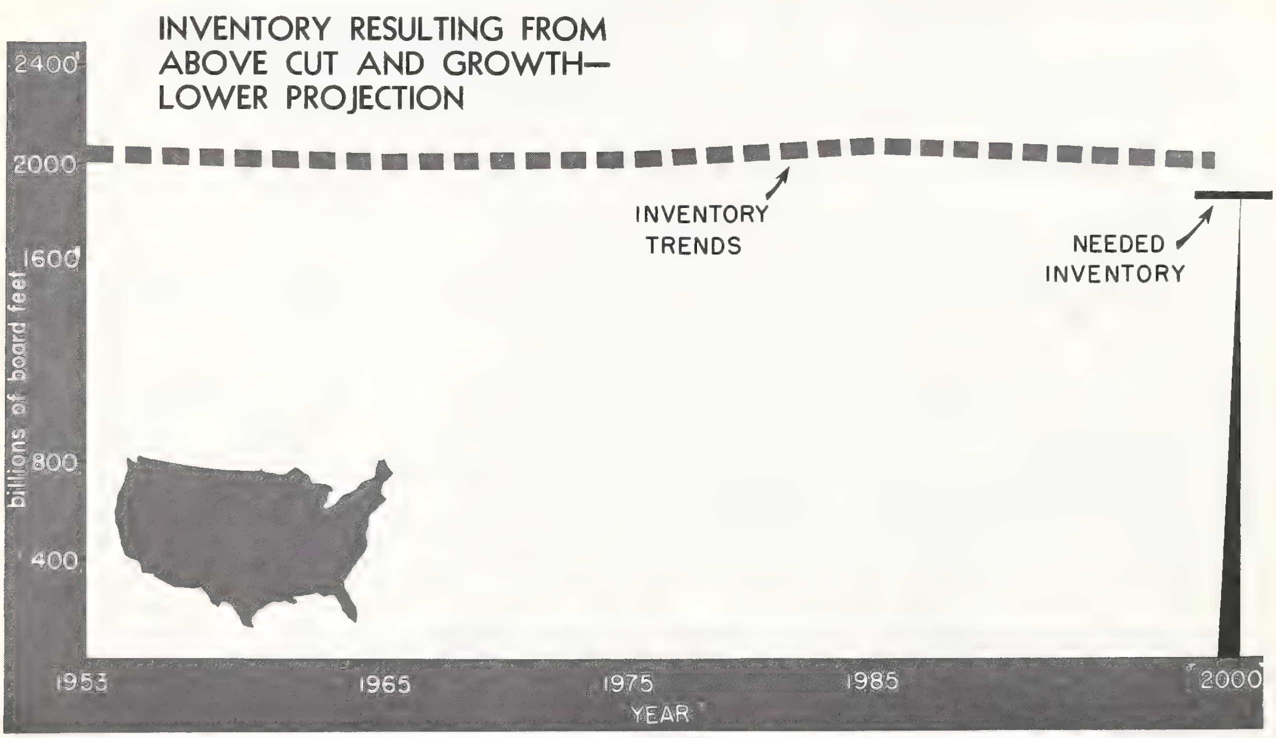
GROWING STOCK

Item	Lower level demand		Upper level demand	
	Projected growth in relation to needed growth	Projected inventory in relation to needed inventory	Projected growth in relation to needed growth	Projected inventory in relation to needed inventory
Eastern hardwoods--	+57	+135	+7	+55
Eastern softwoods--	-19	-21	-93	-96
Western species----	-19	+11	-42	-22
All species------	+6	+39	-45	-20

Although projected inventory of sawtimber will be slightly in excess of needed inventory, projected growth will be about 16 percent below needed growth by the end of the century, and growth and cut will be diverging rather sharply by that time (figure 42 and table 63). In terms of growing stock, projected inventory will be nearly 40 percent above needed inventory and projected growth 6 percent above needed growth.

With better forestry the lower level of needed growth is within the realm of possibility by 2000





INCLUDES COASTAL ALASKA

Figure 42

Consideration of all species together hides important deficits in eastern softwoods and western species, and surpluses in eastern hardwoods. For example, eastern softwood sawtimber inventory will be 36 percent below needed inventory, and growth 29 percent below needs. Likewise, the western situation by 2000 will not be good. Projected growth of sawtimber will be 28 percent below needed growth and will be declining, even though projected inventory will still be in excess of needed inventory.

It is obvious that the softwood situation would be eased if more of the demand were transferred to hardwoods. Although there will be an excess of projected hardwood sawtimber growth and inventory over needs, the growth excess will be only 16 percent. Furthermore, in the estimates of potential demand, substantial increases in hardwood consumption above present proportions have already been assumed. To switch still further to hardwoods would mean use of hardwoods in construction and for industrial purposes to a degree greater than can presently be foreseen.

The situation might further be eased if some or all of the contingency margin were not utilized. Conserving of half the margin would lessen the over-all sawtimber growth deficiency from 16 to about 10 percent.

In conclusion it may be possible to achieve some improvement in sawtimber growth over 1952, and still meet the lower level potential demand at the year 2000. But soon after the turn of the century the pressure on the timber resource would begin to be felt. Eastern softwood inventory, by then 36 percent below the needed level, would continue to drop sharply because growth would be about 30 percent below cut. In the West too, inventory would continue to drop and might go below needed levels unless growth were greater than projected.

These trends indicate that (a) there would not be enough time to build up inventory and growth to needed levels by 2000 under the assumed conditions; (b) it would be necessary to intensify forestry more rapidly or run into a declining timber situation after the turn of the century if lower level demands continued to be met; and (c) eastern softwoods would be in tightest supply due to the large deficiency between projected and needed growth and inventory by 2000.

Upper Level Demand Poses Tremendous Challenge

Projected sawtimber growth under the upper level demand assumptions would increase slowly from the 47 billion board feet in 1952 to 59 billion board feet in 1975; but thereafter it would drop sharply to only 25 billion board feet in 2000 (figure 43).

Projected sawtimber inventory would drop from 2,057 billion board feet in 1953 to 968 billion in 2000, a decline of more than 50 percent.

Projected growth and inventory of sawtimber in 2000 under the upper level demand assumptions are summarized:

	1952-53 (billion bd. ft.)	2000 Needed (billion bd. ft.)	2000 Projected (billion bd. ft.)
Growth	47	105	25
Inventory	2,057	2,796	968

After the timber resource has met upper level demands until 2000 the projected growth would be 75 percent below the needed growth to sustain those demands thereafter, and projected inventory would be 65 percent below needed inventory (table 63).

With respect to individual species groups, the depletion of eastern softwoods would be so pronounced following 1975 that continuation of trends would indicate negligible amounts of eastern softwood inventory and growth by the end of the century. For western

The Upper level of needed growth underlines the tremendous challenge facing American forestry

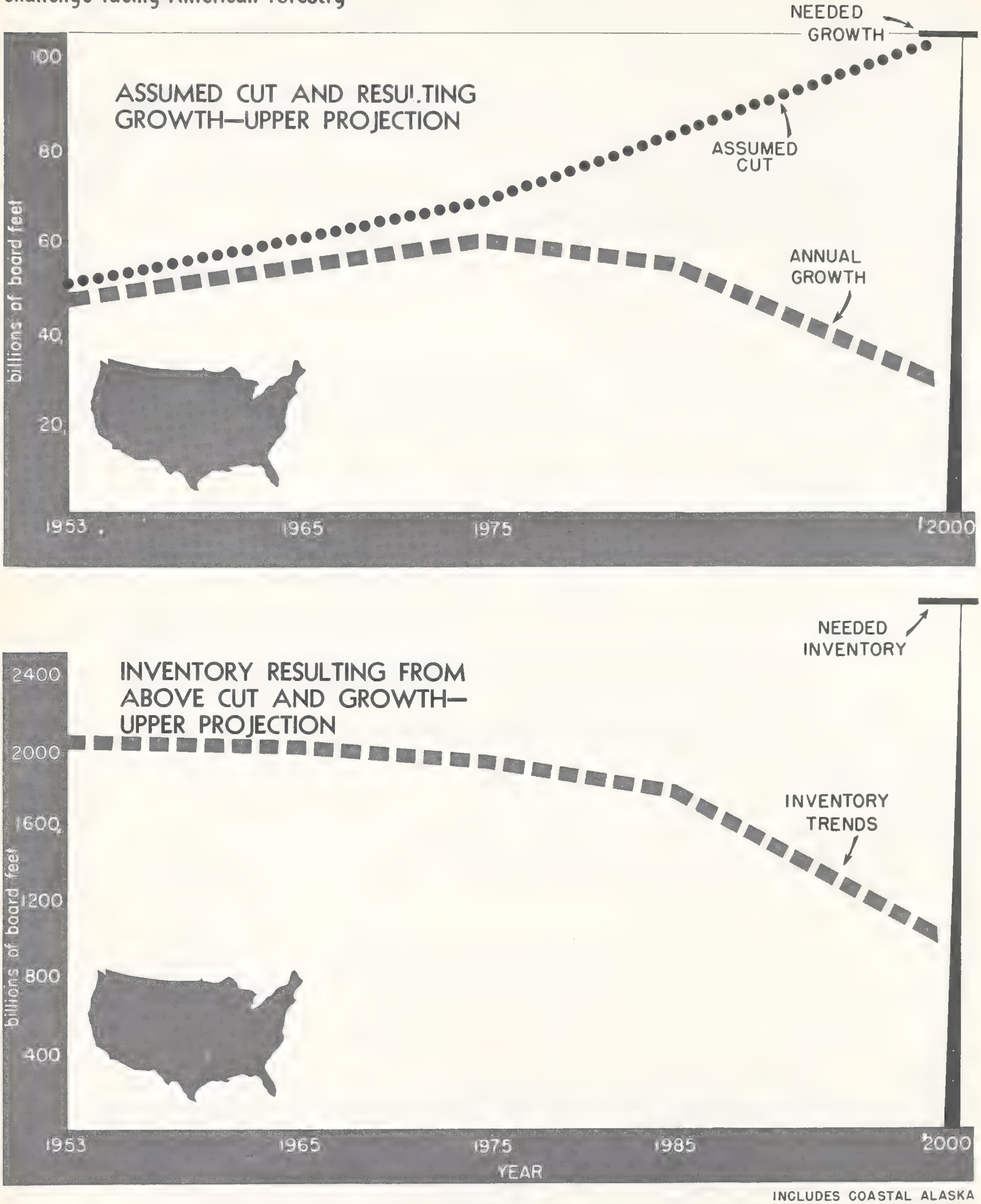


Figure 43

species, sawtimber growth would rise slightly until after 1975, but by 2000 growth would be 61 percent below needed growth, and inventory would be 43 percent below needs. Even the projected growth and inventory of eastern hardwood sawtimber would be greatly deficient--less than half of needed amounts.

In terms of growing stock, the general pattern would be about the same, except that it would not be so pronounced, and eastern hardwoods would show both projected growth and inventory in excess of needed growth and inventory.

In all probability the upper level assumptions of (a) potential demand with its corresponding cut, and (b) maintenance of present forestry trends, would not continue to the year 2000. Long before projected growth and inventory were to reach the estimated levels for 2000, timber would become increasingly hard to obtain, prices would rise, demand would slacken, and forestry effort would become more intensive.

Although the impact on timber inventory and growth of the upper level demands may seem extraordinary, it is important to realize first, those demands are only geared to maintaining wood in its present role in the national economy, and second, the commercial forest land of the Nation, given time, has the productive capacity eventually to produce the needed growth and inventory if sufficiently intensive measures are applied.

It is doubtful if intensive forestry can be achieved to the degree needed on every commercial forest acre, especially in view of the fact that one-fourth of all commercial forest land in the United States is in nearly 4 million private holdings of less than 100 acres apiece. Because of this probable inability to capture more fully the potential of the land, the 489 million acres of commercial forest land may not be any too much to meet the Nation's future needs.

In conclusion, there appears to be no way to meet the upper level demands--i.e., maintain the present role of wood in the national economy--without serious reduction in timber inventories and reduced rates of growth, unless there is intensification of forestry in the near future far beyond what would be achieved by continuation of present forestry trends. Even if this were done, it is questionable whether there is sufficient time to build up growing stocks to meet upper level demands on a sustatined basis by 2000 and to also meet the gradually increasing demands in the meantime.

THE OUTLOOK IN BRIEF

Although there is enough timber now standing on the ground, coupled with what will result from continuation of present trends in forestry, to meet either the lower or upper level demands until the end of the century, such heavy use would have important impacts on the timber resource.

Under the upper level estimates, the Nation would be facing serious wood supply problems before the end of the century, especially in softwood sawtimber. Even hardwood sawtimber would be decreasing. This situation probably will not come to pass because as supply tightened prices would rise, thus checking demand, and forestry would be intensified, thus adding to supply.

Even under the lower level estimates, by the end of the century softwood growth would be considerably below that needed to sustain demand.

In general, the long-range effect of meeting either the lower or upper demands would be about the same. The difference is that the effects would be delayed and less pronounced with respect to the lower level. Under the upper level the impact on the resource will be felt before 2000, whereas under the lower level these impacts would not be as noticeable until after the turn of the century.

To fully appreciate the significance of the preceding statements it is essential to understand that: (1) they are predicated upon continuation of recent trends in forestry

progress; (2) lower level demands--although larger than present consumption--would mean a relative decline in the use of wood, higher consumer prices and lower per capita consumption; (3) upper level demands--which are much larger than present consumption mean that wood would only hold its own in the national economy; and (4) these large, absolute increases in demand result mainly from projected increases in population and gross national product.

Many factors can affect this outlook. A larger timber supply than estimated could result from: More intensive forestry than assumed including higher standards of stocking; reduction in idle land by shortening the time between harvest and regeneration; better utilization than assumed in woods and mill including fuller use of cull volumes and hardwood limbs; use of more timber than assumed from nonforest and noncommercial forest land; and reductions in mortality and growth impact losses beyond those assumed, especially from diseases and insects. In addition the timber from Interior Alaska might come into the commercial market, imports from Canada might be greater than assumed, and the contingency margin might be only partially needed. All these would add to timber supply.

On the other hand, there are important factors which might make the timber situation even more stringent. These could include underestimations of future population and of gross national product and other factors which reflect improvements in standards of living; unforeseen national emergencies; extraordinary catastrophic losses beyond those which the contingency margin could absorb; failure of expected accelerated trends in forestry to actually take place; reductions in the expected availability of forest land due to the extension of highways, urban areas, power lines, and other inroads; failure to achieve expected improvements in utilization; and new uses and unforeseen demands for wood.

Forestry is not a short-time proposition. Where this Nation stands in timber supply in the year 2000 will depend largely on actions taken during the next two decades. Recent encouraging forestry trends must continue, but this is not enough. Acceleration of these trends is vital if the timber resources of the Nation are to be reasonably abundant at the end of the century. Standards and sights must be raised. The potential of the land is adequate. Our challenge is to make use of it.

TWENTY-ONE HIGHLIGHTS

1--Continued expansion of the Nation's economy is expected

Any appraisal of future supply and demand for natural resources involves a choice between such basic assumptions as prosperity or depression, population growth or decline, rising or falling standards of living, and peace or war. The Timber Resource Review is geared to a continued rapid rise in population; economic prosperity and higher living standards as reflected in a continued rise in gross national product; and expectations of peace but continued military preparedness.

One of the most fundamental assumptions is that population of the United States will be 210 million in 1975 and 275 million in 2000, as contrasted to an estimated 165 million in 1955. This is an estimated increase of 67 percent for 2000 above that of 1955, but the trend is about the same as prevailed during the first half of the twentieth century.

Gross national product--the total national output of all goods and services--is estimated to increase from 365 billion dollars in 1952 to 630 billion in 1975 and 1,200 billion in 2000. Although this would be an increase of 229 percent from 1952 to 2000, this trend also is about the same as the actual rate of increase over the past 50 years.

2--Potential demand for timber products is strikingly upward

Two sets of estimates of potential demand were developed for both 1975 and 2000. One set--the so-called "lower level" estimates--was derived from a projection of past consumption trends, product by product, as influenced by the basic economic assumptions. These estimates reflect a relative decrease in the use of wood, declining per capita consumption, and an increase in real price. The other set--the "upper level" estimates--is based on the assumption that wood will continue to occupy about the same place that it does now in the national economy and will continue to make up the same proportion of consumption of all physical structure raw materials as at present. Both the lower and upper level estimates indicate substantial increases over 1952 in the amounts of wood which would be consumed.

The lower level estimate for 2000 indicates that demand for industrial wood (excluding fuelwood) would be 67 percent greater than 1952 consumption. But even with this large absolute increase there would be a decline in annual consumption per capita from 65 to 62 cubic feet.

The upper level estimate for 2000 indicates that demand for industrial wood would be 105 percent above 1952 consumption. This would mean a per capita increase from 65 to 76 cubic feet.

In actual figures potential demand estimates for the year 2000 are 18 and 22 billion cubic feet for the lower and upper level estimates respectively, in contrast to 1952 consumption of some 12 billion cubic feet. These potential demand estimates would require a timber cut of 69 and 95 billion board feet of sawtimber in contrast to the 1952 cut of 49 billion board feet.

3--The United States must rely chiefly on domestic timber resources--with which it is fairly well endowed, compared to other nations

The United States, including all of Alaska, controls 8 percent of the forested area of the world and 15 percent of the timber under exploitation. Although the area is less than that of some nations, the timber volume is greater than that of most. Canada, for example, has more forest area but less timber than the United States, including Alaska. There are

about 4 acres of forest land per capita in the United States, about 9 acres per capita in the U.S.S.R., and about 66 acres per capita in Canada.

In terms of the softwood timber resource, the United States has about 14 percent of the area and 20 percent of the timber volume. Although Canada has a greater softwood area, it has about half as much softwood volume as the United States. More than half of the world's softwood forest area and timber volume belongs to the Soviet Bloc of nations.

It is likely that United States imports from Canada will increase but mainly in terms of pulpwood, pulp, or paper. The extent of Canadian resource, the Canadian potential for increased forest growth, the outlook for expansion of the domestic economy of Canada, and the other demands upon Canada for export of her forest products, all point to some increase in United States imports but in amounts insufficient to contribute materially toward satisfying the increased demand in the United States.

4--The Nation has no excess of forest land

Earlier national appraisals of the timber situation have concluded that there is ample forest land to grow needed timber crops in the United States if the land is effectively used. This is no longer clearly apparent. The long-time trend in the Nation's forest land has been distinctly downward as land has been cleared for agriculture, as highways have been built and as towns have sprung up and urban areas expanded. There has been no great net change in the area of forest land in recent decades despite a small net increase since 1945. In all probability the long-term downward trend will continue due to expected increases in population, further urbanization, continued highway and power developments, and expansion of agriculture. Considering both this trend in land use and the estimates of potential future demand, it is no longer a clear-cut conclusion that there is ample forest land. On the contrary, further significant reductions in the acreage of land devoted to growing trees should in general be avoided or should be made with full realization that such withdrawals may adversely affect future timber supplies.

5--One-fourth of the forest land is poorly stocked or nonstocked

There are 115 million acres of commercial forest land in the United States which are less than 40 percent stocked. This is about one-fourth of the total commercial forest area, and it includes some 42 million acres which are less than 10 percent stocked. Thus, one-fourth of the forest land is not growing and will not grow timber to anywhere near the productive capacity of the land unless stocking is greatly improved. Moreover there is a large but undetermined additional acreage which is 40 to 70 percent stocked. These facts mean that the Nation is not making effective use of the land now devoted to forest production.

6--Three-fourths of the forest land is in the East but two-thirds of the sawtimber volume is in the West

The great bulk of the commercial forest land is in the more heavily populated and industrialized eastern half of the country, with three regions, the Southeast, Lake States, and West Gulf Regions, having 40 percent of the national total. On the other hand, the West, including Coastal Alaska, with only one-fourth of the commercial forest area, has 70 percent of the sawtimber volume. This is due mainly to heavy stands on the 50 million acres of remaining western old-growth timber. Three States, Oregon, California, and Washington, have about half of the Nation's sawtimber. This great difference in the geographical distribution of forest land in contrast to that of standing timber means that ultimately there will be a significant readjustment in forest industries and of timber cut in order to bring them more in harmony with the location of forest land and its productive capacity.

7--Total timber volumes about the same as in 1945

Direct comparisons of timber volumes between those reported by the Timber Resource Review and by the appraisal of the timber situation conducted by the Forest Service

in 1945 are not possible. In order to be compared, standing timber volumes need to be adjusted to the same standards.

The 1953 sawtimber volume is 1,968 billion board feet (excluding Coastal Alaska), which is 2 percent below the adjusted 1945 volume. Sawtimber comparisons show that eastern softwoods declined 2 percent, eastern hardwoods increased 9 percent, and western species declined 5 percent. The 1953 volume of growing stock of 498 billion cubic feet is 2 percent above the adjusted 1945 volume. The most significant features of these trends are the increase in eastern hardwoods and the small decrease in eastern softwoods. The latter should be substantially increasing if future potential demands are to be met.

8--Heavy reliance placed on small group of species

Douglas-fir and ponderosa pine account for 37 percent of the sawtimber volume; southern yellow pines and the oaks for 45 percent of the sawtimber growth; and Douglas-fir and southern yellow pines for 48 percent of the cut. Thus, it is evident that heavy reliance is placed on a small group of species although they vary in importance depending upon whether volume, growth, or cut is the criterion.

Western true firs and western hemlock are important in terms of sawtimber volume, accounting for 17 percent of the total, but are relatively unimportant at the present time in terms of growth and cut.

9--Timber quality is declining

There is much evidence that standing timber is declining in quality: 10 percent of total timber volume is in cull trees; two-thirds of eastern hardwood sawtimber would probably classify as Grade 3 logs; one-fourth of eastern softwood sawtimber is in the smallest sawtimber diameter class; preferred species or types are gradually being replaced in many areas; and the proportion of total timber volumes in the larger trees is decreasing. This decline in timber quality is an undesirable trend although not yet a vital factor nationally.

Despite the technological advances which offset in part the need for quality, it is believed that declining quality will become more, instead of less, of a problem during the next several decades.

10--Timber growth is increasing

One of the most favorable factors in the timber situation is that growth is increasing. On a national basis, sawtimber growth was nearly 9 percent more in 1952 than the adjusted growth in 1944. Eastern softwood sawtimber growth is estimated to be 12 percent greater than in 1944 and hardwoods 15 percent greater. One-half of all sawtimber growth occurs in the South, with nearly one-third of the total on southern yellow pine.

In the West, sawtimber growth decreased 3 percent between 1944 and 1952. As old-growth areas in the West are cut and more second-growth stands reach measurable size, western growth should substantially increase.

11--Most eastern species now have favorable growth-cut ratios

Over-all growth-cut comparisons tend to be misleading because they may conceal the often quite different hardwood and softwood comparisons. Likewise, over-all comparisons include the growth-cut situation in the West which is distorted by the large amounts of residual old-growth. Furthermore, balances between growth and cut have little meaning unless the inventory is large enough to meet future potential demands.

However, it is significant that eastern softwood sawtimber growth was 20 percent greater than cut in 1952 and hardwood sawtimber growth was 57 percent greater than cut. The favorable softwood growth-cut ratio was brought about as much by a 16-percent

reduction in cut as by a 12-percent increase in growth. Most eastern species now have favorable growth-cut sawtimber ratios, although they continue unfavorable for a few preferred species. In the West, the ratio of growth to cut was less than in 1945 due to a decrease in growth and an increase in cut.

12--One-fourth of timber cut not utilized

Of the timber cut in 1952, one cubic foot out of every four was not utilized. Unused plant residues and logging residues were about equal in volume and totaled nearly 3 billion cubic feet. One-third of the timber cut for lumber was not used, either for fuel or any other purpose. On the other hand, only 4 percent of the timber cut for pulpwood was not utilized. The best utilization was found in the North (82 percent of the cut was used); the West (74 percent use) and the South (72 percent use) show lesser degrees of utilization.

Logging and plant residues can, of course, never be completely eliminated. However, reduction of unused residues is one effective way of making available timber supplies go farther. About 75 percent of the total timber cut is for sawlogs, and the proportion of timber cut which is unutilized is higher for sawlogs than for any other major product. Here is where the greatest opportunity lies for supplementing timber supplies by closer utilization.

13--Destructive agents, principally insects and disease, take extraordinary toll

If it were not for the effect of destructive agents, sawtimber growth in 1952, instead of about equaling timber cut, would have exceeded it by 25 percent. Insects, disease, fire, and other destructive agents killed nearly 13 billion board feet of sawtimber in that year--an amount equal to one-fourth the growth. Of this, about 3 billion board feet were salvaged. The much larger growth impact--which includes not only 1952 mortality but also growth losses in 1952 and subsequent years resulting from 1952 damage--was about 44 billion board feet.

Insects killed seven times as much sawtimber as did fire in 1952 and disease three times as much. In terms of growth impact, disease outranked both insects and fire by more than two to one. The much greater effect of insects and disease in contrast to fire is doubtless due to the greater progress made in fire prevention and control. If the toll of insects and disease could be similarly lessened, a large contribution would have been made toward the growth needed to meet potential future demands.

14--Fifty million acres are plantable

Although planting rates have increased greatly in recent years, and forest plantations in the United States cover about 5 million acres, there is a big job of planting ahead, mainly in the East and mainly on private lands. About 50 million acres, or 10 percent of all commercial forest land in the Nation, needs planting if it is to become productive within a reasonable time. This estimate is conservative in that it does not include areas where it is possible to improve stocking by interplanting or where, by planting promptly after cutting without waiting for natural regeneration, it is possible to reduce the time that lands lie idle. If adequately reforested, the area in need of planting might eventually add about 8 billion board feet annually to timber supplies.

15--Forest condition poorest on small farm and "other" private ownerships, especially in the South

There is conclusive evidence that the condition of recently cut lands is poorest on the farm and "other" private ownerships. The latter means private ownerships, generally small in size, which are not farm and not forest industry. These two groups of forest holdings involve nearly 4.5 million private owners and account for 60 percent of the Nation's total commercial forest land. For the country as a whole, only about 40 percent of the farm and 50 percent of the "other" private ownerships qualified recently cut lands for the upper productivity class.

Small private holdings, regardless of kind of ownership, clearly showed poorer productivity than large and medium sized properties. Geographically, productivity of recently cut lands is considerably lower in the South than in other parts of the country, and the farm and "other" private ownerships show poorer ratings for the South than for other sections.

Considering location as well as kind and size of ownership, the small private ownerships of the South are conspicuously below the rest of the country in condition of cutover lands. These holdings, numbering 1.8 million, are owned mainly by farmers and the miscellaneous nonforest industry group that makes up the "other" private category. They comprise 128 million acres, or one-fourth of all commercial forest land of the Nation. Two-thirds of the recently cut lands in this group fail to approximate productivity standards reasonably attainable under average current conditions.

16--Forest condition best on public and forest industry ownerships

In contrast to farm and "other" private ownerships, about three-fourths of the recently cut lands owned by public agencies and the forest industries qualified for the upper productivity class. Two-thirds of the land owned by forest industry is in large holdings. There was little difference between public ownerships as a group and forest industry as a group. However, there were appreciable variations between different parts of the country, different forest industries, and different public ownerships. The pulp industry with 84 percent of its recently cut lands qualifying for the upper productivity class exceeded the national forests with 81 percent and the lumber industry with 73 percent.

These findings show that there is little distinction between condition of cutover lands in public ownership as contrasted to those owned by forest industry. The contrast is between public and forest industry ownerships on the one hand, which comprise about 40 percent of the Nation's commercial forest land and have 75 to 80 percent of cutover lands in the upper productivity class, and the farm and "other" private ownerships on the other hand, which make up 60 percent of the forest land and have about 46 percent of their recent cutovers in the upper class.

17--Inadequate stocking is most significant factor in reducing productivity of recently cut land

Over half of the land cut over since 1947 would have been ruled out of the upper productivity class on account of deficiencies in existing stocking. A considerable portion of this area was restored to the upper class due to reasonable prospects of stocking. The fact remains that understocking is the most important cause of recently cut lands failing to measure up to standard.

18--Improved stocking and control of insects and disease offer best possibilities of increasing timber supplies

In addition to timber from commercial forest land in the continental United States and Coastal Alaska, there are several possible supplementary sources which need to be placed in proper perspective. In terms of standing timber there are unknown quantities on reserved but productive forest land and on nonforest land. There are also 180 billion board feet of sawtimber in Interior Alaska, and 37 billion board feet in salvable dead trees in the United States and Coastal Alaska. There are 56 billion cubic feet of sound volume in cull trees available for products not requiring high quality material.

On an annual basis there are 2.2 billion board feet of sawtimber consumed for fuel, some of which might be used for other products, and there are 2.7 billion board feet of sawtimber in the form of unused residues. Net imports from Canada might be increased somewhat above the anticipated level (1.2 million cubic feet) assumed in estimating potential demand.

However, the best possibilities for permanently adding to timber supplies seem not to be any of these but instead (a) reducing the nonsalvaged mortality loss of 10 billion board feet annually--four-fifths of which is due to insects and disease, (b) capturing most of the 8 billion board feet annual sawtimber growth potential from the 50 million plantable acres, (c) improving the stocking on the one-fourth of the commercial forest land of the Nation which is medium or poorly stocked, and (d) obtaining sufficiently prompt and adequate restocking on cutover areas so as to maintain their productivity.

19--The key to the Nation's future timber supplies lies with the millions of farm and "other" private holdings

The greatest advancements in forestry, the best conditions on recently cut lands, and over half the Nation's inventory of softwood sawtimber occur on forest industry and public land. The 23,000 forest industry ownerships account for 13 percent of the commercial forest land; public lands, 27 percent.

In contrast, the farm and "other" private ownerships have the poorest cutover conditions, are largest in total area, largest in number of owners, and potentially the largest in total timber volumes. Eighty-five percent of these 4.5 million ownerships are in forest holdings of less than 100 acres, and 50 percent have holdings of less than 30 acres.

Unquestionably, the heart of the forest problem of the United States lies with the 3.4 million farm owners and the miscellaneous group of 1.1 million "other" private ownerships. Although they own mainly very small tracts of forest land, and their principal interests usually are not timber growing, in the aggregate they control well over half of the Nation's commercial timberland and they must continue to supply a substantial portion of the raw materials for forest industry.

20--Growth and inventory needed to sustain potential demands will be much greater than at present

Comparison of present levels of growth and inventory with how much is needed helps to indicate how easy or difficult it may be to meet future demands on a sustained basis.

Estimates of needed growth in 2000 range from 79 to 105 billion board feet of sawtimber, or from 67 to 122 percent above 1952 levels. The lower estimate is based on a lower level demand which reflects a relative decrease in the use of wood, declining per capita consumption, and an increase in the real price of timber products. The upper estimate assumes that wood will continue to occupy about the same role as at present in the national economy.

By 2000, eastern softwood sawtimber growth would need to increase 90 to 154 percent, eastern hardwoods 15 to 52 percent, and western species 121 to 194 percent, depending on whether needs are geared to lower or upper level estimates of demand.

Considering all species together, the changes needed in standing timber inventory are not nearly so pronounced. Although a slight decrease would be possible and still meet lower level demands, about a one-third increase in sawtimber inventory would be needed to sustain the upper level. The needed increases in inventory of eastern species are relatively greater than the needed growth increases for these species. These are offset in part by allowable decreases in the inventory of western species.

21--Potential demands pose tremendous challenge to American forestry

A comparison of the growth and inventory that may be expected in the future with what may be needed to sustain future demands is more significant than comparing future needs with current levels. Projected growth and inventory are what might be expected in the future if all demands are met in the meantime, and if current trends in forestry continue.

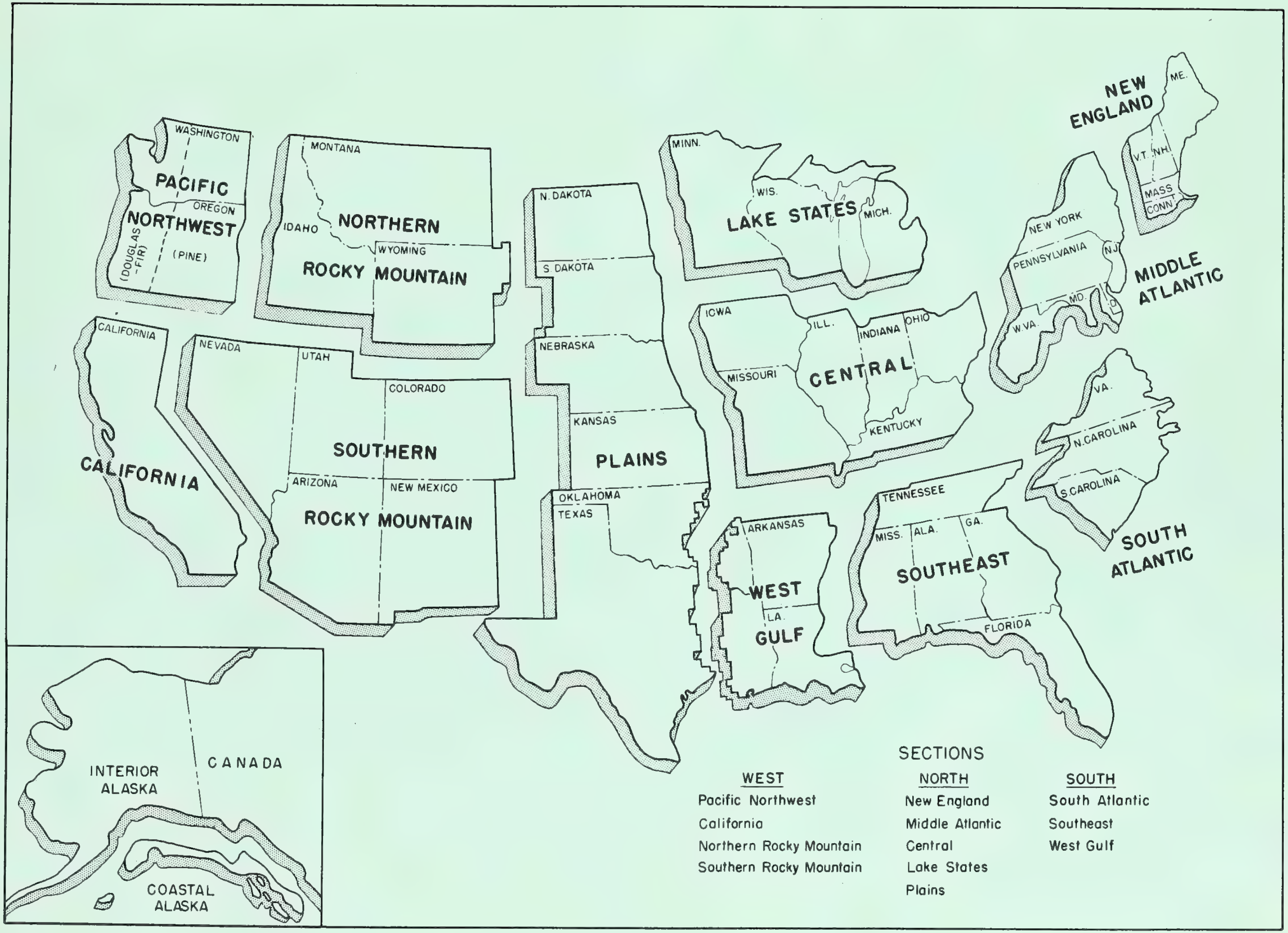
Projected sawtimber growth in 2000 ranges from 67 to 25 billion board feet, or from 16 to 76 percent below needed growth for the lower and upper levels of demand respectively. By 2000 eastern softwood sawtimber growth would range from 29 percent below needed growth down to negligible amounts, eastern hardwoods from 16 percent above to 58 percent below, and western species from 28 to 61 percent below depending on whether timber cut had been geared to lower or upper level demands in the meantime.

Projected sawtimber inventory in 2000 ranges from 2, 002 to 968 billion board feet, or from 6 percent above to 65 percent below needed inventory for the lower and upper levels of demand respectively. Eastern softwood inventory would be seriously affected under either level of demand but under the impact of meeting upper level demands, the inventory of both eastern and western species would be less than half of needs.

In general, the long-range effect of meeting either level of demand would be about the same. The difference is that the effects would be delayed and less pronounced with respect to the lower level. If upper level estimates of demand are met until the end of the century the Nation would be facing serious wood supply problems before that time, especially in softwood sawtimber. Even hardwood sawtimber would be decreasing. If the lower level estimates prevail, softwood growth by the end of the century would be considerably below that needed to sustain demand.

To fully appreciate the significance of these interpretations, it is essential to bear in mind they are predicated upon a continuation of recent trends in forestry progress. If existing levels of forestry had been assumed and no recognition given to probable intensification, the outlook would be far less favorable.

Forestry is not a short-time proposition. Where this Nation stands in timber supply at the end of the century depends largely on actions taken during the next two decades. Rapid acceleration of recent encouraging forestry trends is vital if the timber resources of the Nation are to be reasonably abundant 50 years hence. Because of the magnitude of potential demand, and the difficulty of extending more intensive forestry to the millions of small holdings, time is important. The potential of the land is adequate. Our challenge is to make better use of it soon.



Regions and Sections used in the Timber Resource Review

TIMBER RESOURCE REVIEW

CHAPTER II
DOMESTIC SUPPLY OF FOREST LAND AND TIMBER

(Preliminary Review Draft Subject To Revision)

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INDEX TO TIMBER RESOURCE REVIEW REPORTS AND APPENDIX MATERIAL

(Each Chapter and each Section, in the case of Chapters IV and IX, is a separate document)

CHAPTER II. DOMESTIC SUPPLY OF FOREST LAND AND TIMBER

(Preliminary review draft subject to revision)

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September, 1955

Contents

DOMESTIC SUPPLY OF FOREST LAND AND TIMBER

The present status of forest land and the present volume of timber on it are major considerations in reviewing the nation's timber resources. With more accurate and comprehensive information being assembled about the condition and extent of forest land and the volume, kind and quality of timber, it is now possible to bring into focus a clearer picture of the domestic timber supply. To present the major relationships involved, this chapter describes our forest land and timber resource. The text is keyed chiefly to regional data. 1/

FOREST LAND

Of the nearly 2 billion acres of land in the United States and Coastal Alaska, 34 percent, or 664 million acres, are classified as forest land (fig. 1). This is the land which Americans and even others must look to for a future supply of forest products. How the forest land is used, where it is located, who owns it, and what its capacity is to produce, are all considerations bearing heavily on the welfare and security of the nation.

The forest area is far from homogeneous. There are concentrations of softwood (coniferous) forests in the West, but these are often broken up by agricultural valley lands or by wide stretches of grazing land. West of the Cascade Mountains in Washington and Oregon there are extensive areas of Douglas-fir. Redwood, Douglas-fir and mixed conifer forests predominate in California. East of these coastal forests in the West, ponderosa pine forests are most prevalent, but white pine and larch are common in the Northern Rockies, whereas lodgepole pine forests and stands of fir and spruce are found at higher elevations further south. Midcontinent in the Plains States there are river-bottom stringers of hardwoods (deciduous trees) and the pine forests of the Black Hills. In the North and South, the softwood and hardwood forests are intermingled and, almost everywhere, interspersed with farms and other nonforest lands. A wide band of oak-hickory forest stretches from Southern New England to Missouri and Oklahoma, separating the pine forests of the South from the maple-birch-beech, spruce-fir, and other types of northern forest. Alaska with its vast expanse, has dense coniferous forests in a narrow coastal belt along the southeastern panhandle. Less dense coniferous and birch forests extend far into the interior.

All of the forest area usually is not taken into account when appraising the timber resource. Generally, two classes of forest land

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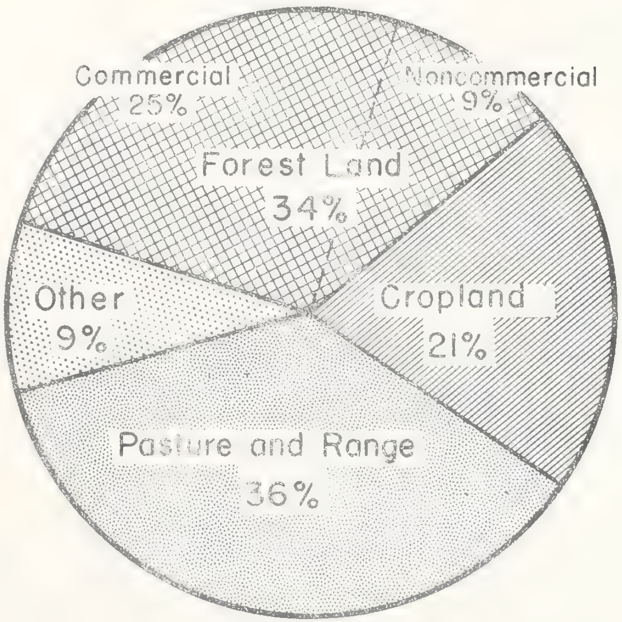
1/ If the reader seeks more statistical detail than is presented in the subsequent text and summary tables, he should refer to the complete statistical summaries in the Appendix where much additional data may be found.



	United States	Coastal Alaska	Total
	Thousand Acres		
Forest Land	647,686	16,508	664,194
Commercial	484,340	4,269	488,609
Noncommercial	163,346	12,239	175,585
Cropland	411,148	3	411,151
Pasture and Range	693,246	91	693,337
Other	151,744	18,917	170,661
Total Land Area	1,903,824	35,519	1,939,343

Fig. 1 - Land area of continental United States and Coastal Alaska, by major economic Uses.

are recognized, commercial and noncommercial. The commercial lands are those which are looked to primarily for meeting timber requirements and noncommercial lands are those which have only limited possibilities for timber production and have greater values for other forest uses. As of the beginning of 1953, about three-fourths of the 664 million acres of forest land were classified as commercial and one-fourth as noncommercial (table 1).

DISTRIBUTION OF FOREST AREAS AND TYPES

Commercial Forest Land

Three-fourths of the Commercial Forest Land is in the East

The total area of the commercial forest land in the United States is 484 million acres and in Coastal Alaska there are an additional 4 million acres. These are the areas with which this report is concerned primarily, for from this land must come most of the timber to meet our future requirements. Distribution of the commercial area varies by forest regions (fig. 2). The eight eastern forest regions have three-fourths of the commercial forest land and the four western regions have one-fourth. Three eastern regions, the Southeast, Lake States, and West Gulf, each have over 50 million acres of commercial land and collectively include 41 percent of all the commercial forest land in the United States. Regions having the least acreage of commercial forest land are the Plains, California, and the Southern Rocky Mountain, each having less than 25 million acres.

Some forest regions have a much higher percentage of commercial forest land than others (fig. 3). For example, in New England 76 percent of the total land area is classed as commercial forest whereas, for the United States and Coastal Alaska, 25 percent is classed as commercial forest. Falling considerably below this national average are California, the Northern and Southern Rocky Mountain regions, Coastal Alaska, and the Plains.

Hardwood and Softwood Types About Equal in Area

The occurrence and distribution of species associations (forest cover types) are a useful guide as to what to expect in the future timber crop. On the 488 million acres of commercial forest land, 20 major forest type groups are recognized, 10 in the East and 10 in the West. The eastern hardwood types occupy 51 percent of this total acreage. The remainder, except for a relatively small acreage of western hardwood, supports softwood forest types—in area divided almost equally between the East and the West, including Coastal Alaska (fig. 4).

In the East the softwood types are generally preferable to the hardwood types because the market for softwood lumber, pulp and other softwood products is much greater than the market for hardwood products.

Table 1.--Forest land area of the United States and Coastal Alaska, by section, region, and State, 1953

Section, region, and State	Total	Commercial	Noncommercial
	Thousand acres	Thousand acres	Thousand acres
North:			
New England:			
Connecticut	1,990	1,973	17
Maine	17,088	16,601	487
Massachusetts	3,288	3,259	29
New Hampshire	4,848	4,682	166
Rhode Island	434	430	4
Vermont	3,730	3,713	17
Total	31,378	30,658	720
Middle Atlantic:			
Delaware	454	448	6
Maryland	2,920	2,897	23
New Jersey	1,958	1,910	48
New York	14,450	12,002	2,448
Pennsylvania	15,205	15,108	97
West Virginia	9,907	9,860	47
Total	44,894	42,225	2,669
Lake States:			
Michigan	19,322	18,849	473
Minnesota	19,344	18,098	1,246
Wisconsin	16,535	16,325	210
Total	55,201	53,272	1,929
Central:			
Illinois	3,993	3,938	55
Indiana	4,103	4,045	58
Iowa	2,510	2,505	5
Kentucky	11,497	11,446	51
Missouri	15,177	15,064	113
Ohio	5,446	5,396	50
Total	42,726	42,394	332

Table 1--Forest land area of the United States and Coastal Alaska, by section, region, and State, 1953 - continued

Section, region, and State	Total	Commercial	Noncommercial
	Thousand acres	Thousand acres	Thousand acres
North:-cont'd.			
Plains:			
Kansas	1,668	1,664	4
Nebraska	1,482	1,480	2
North Dakota	433	414	19
Oklahoma (west)	4,302	650	3,652
South Dakota (east)	776	684	92
Texas (west)	26,000	600	25,400
Total	34,661	5,492	29,169
Total, North	208,860	174,041	34,819
South:			
South Atlantic:			
North Carolina	19,513	18,976	537
South Carolina	11,943	11,891	52
Virginia	15,832	15,285	547
Total	47,288	46,152	1,136
Southeast:			
Alabama	20,771	20,756	15
Florida	23,047	21,519	1,528
Georgia	24,057	23,969	88
Mississippi	16,473	16,440	33
Tennessee	12,558	12,301	257
Total	96,906	94,985	1,921
West Gulf:			
Arkansas	19,346	19,292	54
Louisiana	15,990	15,899	91
Oklahoma (east)	6,027	5,257	770
Texas (east)	11,708	11,703	5
Total	53,071	52,151	920
Total, South	197,265	193,288	3,977

Table 1.--Forest land area of the United States and Coastal Alaska, by section, region, and State, 1953 - continued

Section, region, and State	Total	Commercial	Noncommercial
	Thousand acres	Thousand acres	Thousand acres
West:			
Pacific Northwest:			
Douglas-fir subregion	29,047	25,455	3,592
Pine subregion	25,082	19,910	5,172
Total	54,129	45,365	8,764
Oregon	30,261	25,875	4,386
Washington	23,868	19,490	4,378
Total	54,129	45,365	8,764
California	42,541	17,317	25,224
Northern Rocky Mountain:			
Idaho	21,025	13,372	7,653
Montana	22,330	15,727	6,603
South Dakota (west)	1,393	1,266	127
Wyoming	10,513	3,475	7,038
Total	55,261	33,840	21,421
Southern Rocky Mountain:			
Arizona	19,212	3,180	16,032
Colorado	20,834	8,451	12,383
Nevada	12,036	109	11,927
New Mexico	21,329	5,735	15,594
Utah	16,219	3,014	13,205
Total	89,630	20,489	69,141
Total, West	241,561	117,011	124,550
Continental United States	647,686	484,340	163,346
Coastal Alaska	16,508	4,269	12,239
All regions	664,194	488,609	175,585

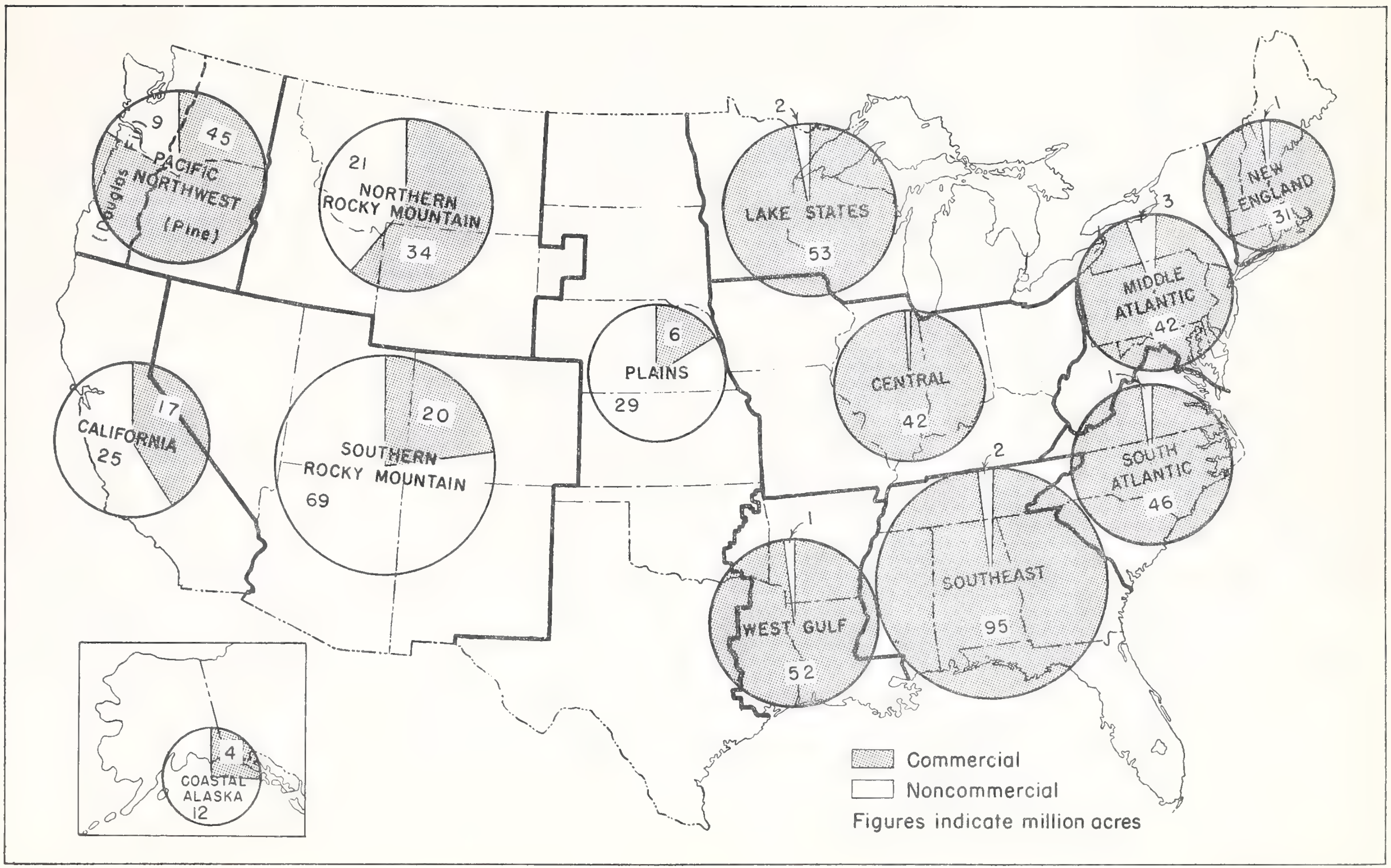


Fig. 2. —Forest lands of United States and Coastal Alaska by regions

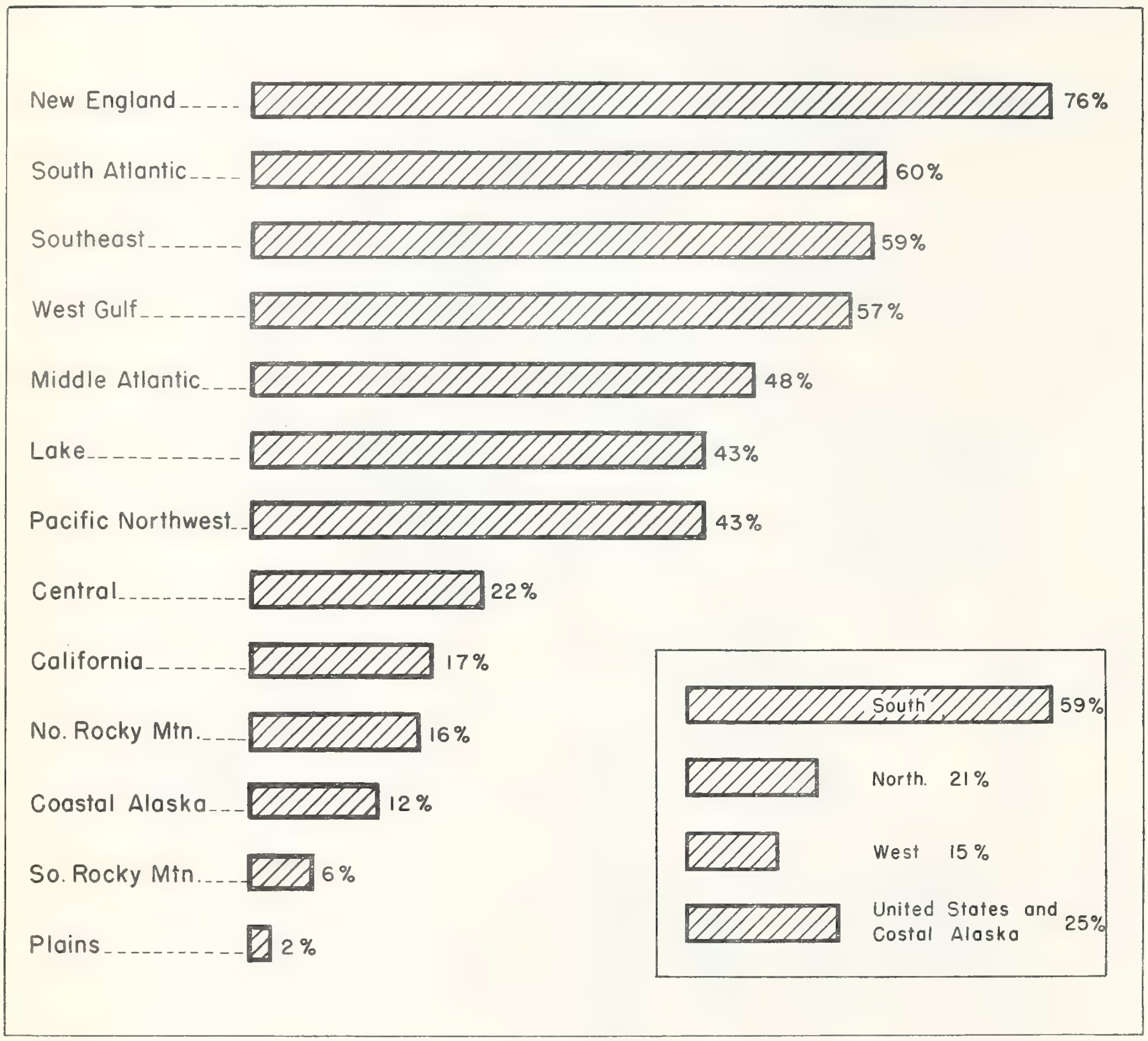


Fig.-3 - Percent of total land area classed as commercial forest land

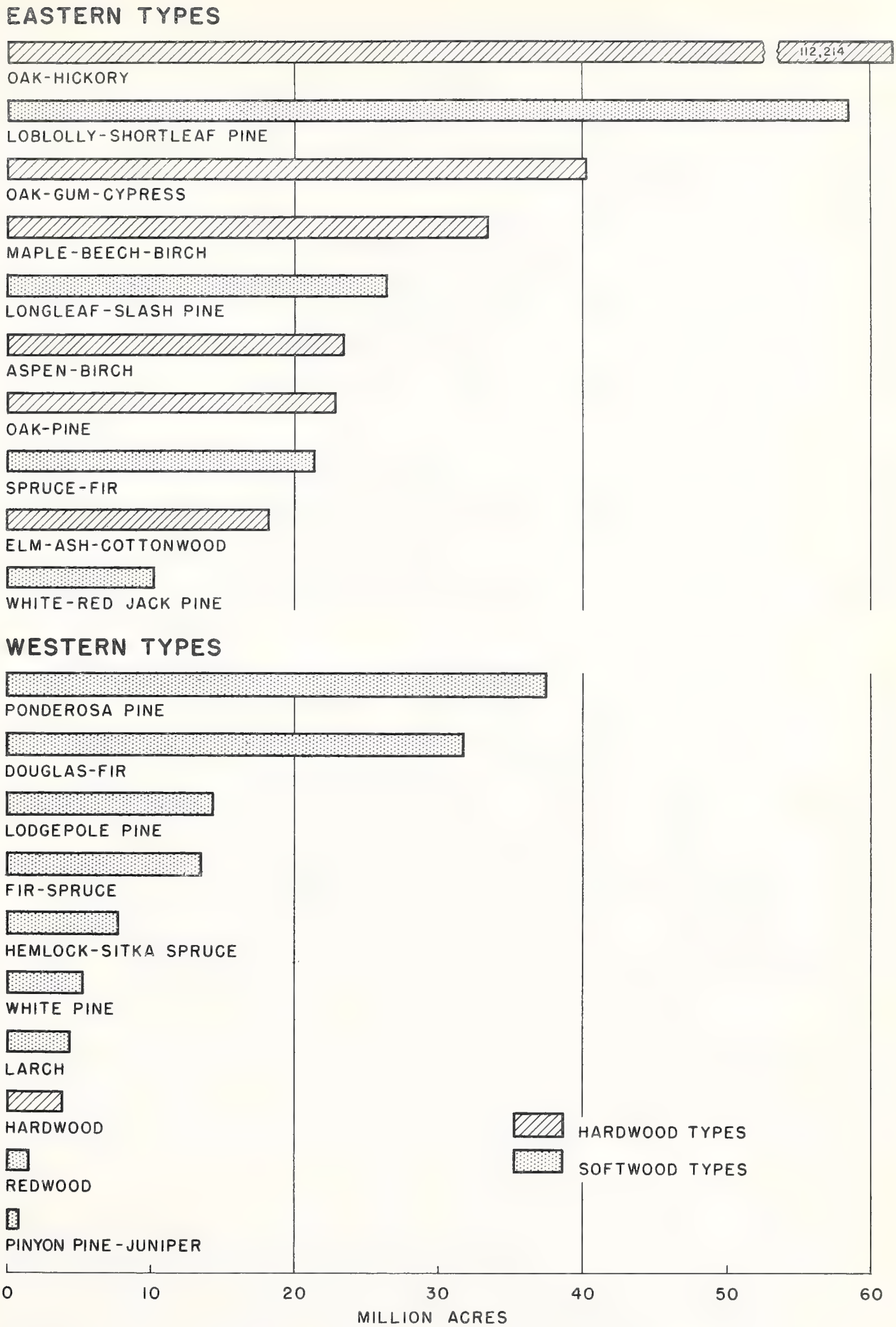


Fig. 4 - Area of major forest types on commercial forest land

Most extensive is the loblolly pine-shortleaf pine type group,[2] which accounts for half of the eastern softwood type area (table 2). Nearly one-fourth of the area is occupied by the longleaf pine-slash pine type group--most of it located in the Southeast--upon which the important naval stores industry is based. Together these two pine type groups, occupying some 40 percent of the South's commercial forest land, comprise the major softwood timber-producing area in the East.

The other eastern softwood type groups, spruce-fir and white-red-jack pine, occur mainly in the northern Lake States and in northern New England. Spruce-fir forests have been a mainstay of the pulp industry since the industry was founded. White-red-jack pine occurs today only as remnants of a once extensive forest. The white pine forests of the Lake States and the Northeast are still of some importance in local areas, but they played their chief role many years ago.

Eastern hardwood types have some highly valuable species, but they are frequently characterized by low quality. Oak-hickory, most widespread of all eastern type groups, occupies nearly half of the eastern hardwood area and is represented by a large number of species and types growing on a wide variety of sites. For many years oak-hickory has presented a problem because of poor quality. "Scrub oak" has become a common local name for a sizable part of the acreage in this type group.

In the Northeast and, to a lesser extent, in the Lake States, there are extensive areas of maple-beech-birch, a highly valuable type group that occupies about one-fifth of the commercial forest land in the North. Sugar maple and yellow birch are its most important species. Swamp and bottomland forests of the oak-gum-cypress and elm-ash-cottonwood type groups cover about one-fourth of the eastern hardwood area. There are large areas of the former in the Lower Mississippi Valley and along streams in the southern Coastal Plain. The remainder of the eastern hardwood area supports types belonging to the oak-pine and aspen-birch groups. The former occupies areas along the fringes of the oak-hickory belt or scattered through the southern pine region. The aspen-birch types are pioneer types that have invaded large areas of cutover pine land in the North.

In the West, from an area standpoint, the most important type group is ponderosa pine which covers about one-third of the commercial forest land (table 3). In the more arid sections, an open woodland forest of ponderosa pine is typical; dense stands are characteristic where rainfall is more plentiful. Ponderosa pine not only occupies a

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2/ In all type groups, the species for which the group is named are generally most abundant, but they may be scarce or absent in some parts of the type-group area. In New Jersey, New York, and Massachusetts, for example, pitch pine is the chief representative of the loblolly-shortleaf pine type group. In the northern Appalachians, Virginia pine is common and loblolly pine may be entirely absent.

Table 2.--Areas of commercial forest land occupied by the major eastern forest type groups, by section and region, 1953 (Eastern United States)

Forest type group	Total, Eastern U. S.	North						South			
		Total	New England	Middle Atlantic	Lake States	Central	Plains	Total	South Atlantic	Southeast	West Gulf
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
Softwoods:											
White-red-jack pine	10,299	9,985	3,418	1,649	4,445	31	1/442	314	208	106	..
Longleaf-slash pine	26,491	..	..	..	..	..	..	26,491	1,564	22,346	2,581
Loblolly-shortleaf pine	58,505	3,737	165	2,772	..	580	220	54,768	16,319	22,751	15,698
Spruce-fir	21,462	21,444	10,560	868	10,016	..	..	18	16	2	..
Total, softwoods	116,757	35,166	14,143	5,289	14,461	611	662	81,591	18,107	45,205	18,279
Hardwoods:											
Oak-pine	22,889	2,445	49	564	..	1,722	110	20,444	5,479	8,704	6,261
Oak-hickory	112,214	58,574	3,180	18,624	6,443	28,994	1,333	53,640	14,919	24,104	14,617
Oak-gum-cypress	40,293	4,919	..	2,716	..	1,283	920	35,374	7,389	15,993	11,992
Elm-ash-cottonwood	18,278	16,828	824	1,424	4,609	7,638	2,333	1,450	..	448	1,002
Maple-beech-birch	33,449	32,660	10,558	10,732	9,308	2,062	..	789	258	531	..
Aspen-birch	23,449	23,449	1,904	2,876	18,451	84	134	..	..	..	..
Total, hardwoods	250,572	138,875	16,515	36,936	38,811	41,783	4,830	111,697	28,045	49,780	33,872
Total, all types	367,329	174,041	30,658	42,225	53,272	42,394	5,492	193,288	46,152	94,985	52,151

1/ Four hundred forty-two acres of ponderosa pine type.

Table 3.--Areas of commercial forest land occupied by the major western forest type groups, by section and region, 1953 (Western United States and Coastal Alaska)

Forest type group	Coastal Alaska	Total, Western U. S.	West					
			Pacific Northwest			California	Northern Rocky Mountain	Southern Rocky Mountain
			Total	Douglas-fir subregion	Pine subregion			
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
Softwoods:								
Douglas-fir	..	31,731	20,141	18,270	1,871	4,378	6,222	990
Hemlock-Sitka spruce	4,263	3,551	3,545	3,518	27	6	..	..
Redwood	..	1,590	2	2	..	1,588	..	..
Ponderosa pine	..	37,462	13,403	678	12,725	6,057	7,879	10,123
White pine	..	5,379	591	262	329	2,255	2,520	13
Lodgepole pine	..	14,467	2,054	207	1,847	300	9,649	2,464
Larch	..	4,422	1,149	..	1,149	..	3,273	..
Fir-spruce	..	13,619	3,442	1,634	1,808	2,733	2,707	4,737
Pinyon pine-juniper	..	855	..	..	..	..	855	..
Total	4,263	113,076	44,327	24,571	19,756	17,317	33,105	18,327
Hardwoods	6	3,935	1,038	884	154	..	735	2,162
Total, all types	4,269	117,011	45,365	25,455	19,910	17,317	33,840	20,489

large acreage in the pine subregion of the Pacific Northwest, but it is also the most extensive commercial forest type in California and in the Southern Rocky Mountain Region.

About one-fourth of western commercial forest land carries stands in which Douglas-fir predominates. Most of the Douglas-fir area is found in the Pacific Northwest but the type group is also widespread in the Northern Rocky Mountain Region and in California.

While none of the other eight western type groups approaches ponderosa pine or Douglas-fir in acreage, several are significant in relation to timber supply. Two type groups, western white pine and redwood, are noted because of the high quality and specialty uses of their predominant species. Larch types, though of lesser importance nationally, are a major source of poles and sawlogs in the Northern Rocky Mountain Region. The hemlock-Sitka spruce type group accounts for nearly all of the commercial forest land in Coastal Alaska and is the characteristic forest type along the coast in Washington and Oregon. In both regions, the pulp and lumber industries look to this type group for wood supplies. The lodgepole pine types and the fir-spruce types are widely distributed, particularly in the Rocky Mountain region. For the present, at least, the water values of both of these type groups far exceed their timber values. The commercial forest area of the other western softwood type group, pinyon pine-juniper, is minor. It is classed as a commercial forest type only in the Northern Rocky Mountain Region where its stands contain some ponderosa pine; elsewhere it is classed as noncommercial. Western hardwood types occupy only 3 percent of the commercial forest land in the West and less than 1 percent of the commercial forest land in Coastal Alaska. Hardwood types are of very little importance in the timber economy of the West.

Noncommercial Forest Land

One-fourth of the forest land area is classified as noncommercial. Included are 160 million acres of unproductive forest land and 15 million acres of productive forest land that is reserved from timber use (table 4). About 12 million of the unproductive acres are also reserved for some special use such as recreation. Regionally, practically all of the noncommercial forest lands are found in the West, Coastal Alaska, and the Plains States. The largest concentration, 69 million acres, is in the Southern Rocky Mountain Region. Other sizable blocks are in southern California and in Texas. In four regions, more than 50 percent of all the forest land is noncommercial: 84 percent in the Plains, 77 percent in the Southern Rocky Mountain Region, 74 percent in Coastal Alaska, and 59 percent in California. East of the Plains, only New York, Florida, and Minnesota have more than 1 million acres of noncommercial forest land (fig. 5).

Noncommercial forests are made up of various forest types. Productive but reserved lands, widely scattered through forest areas, carry the same types that appear on commercial forest land. This is also true—though to a lesser extent—of some of the unproductive forest areas such as the forested swamps in the Lake States, the precipitous

Table 4.--Noncommercial forest area by section and region, 1953
(United States and Coastal Alaska)

Section and region	Total	Productive but reserved	Unproductive	
			Reserved	Unreserved
	Thousand acres	Thousand acres	Thousand acres	Thousand acres
North:				
New England	720	232	85	403
Middle Atlantic	2,669	2,552	..	117
Lake States	1,929	718	32	1,179
Central	332	247	..	85
Plains	29,169	26	41	29,102
Total	34,819	3,775	158	30,886
South:				
South Atlantic	1,136	668	39	429
Southeast	1,921	387	186	1,348
West Gulf	920	160	10	750
Total	3,977	1,215	235	2,527
West:				
Pacific Northwest				
Douglas-fir subregion	3,592	1,551	827	1,214
Pine subregion	5,172	688	556	3,928
Total	8,764	2,239	1,383	5,142
California	25,224	1,202	1,941	22,081
Northern Rocky Mtn.	21,421	4,518	4,450	12,453
Southern Rocky Mtn.	69,141	1,612	2,796	64,733
Total	124,550	9,571	10,570	104,409
Continental United States	163,346	14,561	10,963	137,822
Coastal Alaska	12,239	183	701	11,355
All regions	175,585	14,744	11,664	149,177

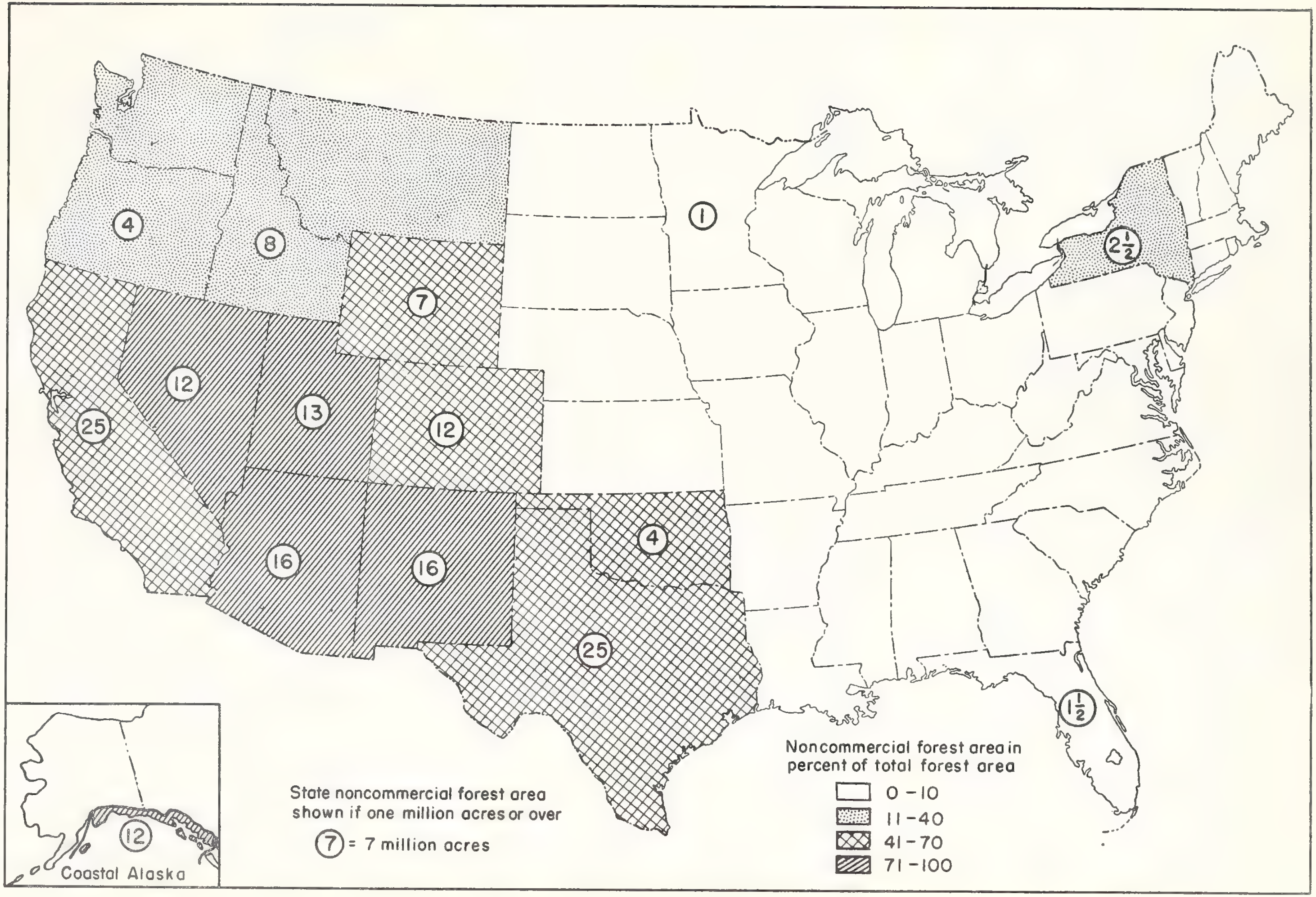

Fig. 5 - More than three-fourths of the non-commercial forest land is found in the West and Coastal Alaska

coastal slopes with sparse tree cover in Coastal Alaska, and the rocky subalpine forests in the West. However, much of the unproductive acreage in the West occurs along the dry lower margins of commercial forests, or in isolated tracts on the fringes of more arid rangelands. Here the greatest acreage is in the pinyon pine-juniper type and the hardwood types:

Region	Pinyon pine-juniper thousand acres	Hardwood thousand acres
Southern Rocky Mountain	50,978	6,180
California	6,316	9,233
Plains (west of 100th meridian)	938	3,459
Northern Rocky Mountain	731	1,378
Pacific Northwest	1,537	364
Total	60,500	20,614

The noncommercial hardwood types are mostly woodland types in which the principal species is oak, but scattered stands of alder, tanoak, cottonwood and other hardwood trees are also occasionally included. In addition to the area in these two types, there are another 38,000 acres of unproductive forest land in the four regions west of the Plains, occupied by chaparral, sparse stands of open-grown ponderosa pine, other hardwood types such as blue oak in California, and various conifer types such as digger pine and knobcone pine.

Although most noncommercial areas have extremely limited value from the standpoint of timber production, they have other forest uses of great importance. The reserved areas include such forest lands as those in State and national parks and wilderness areas. Yellowstone National Park and the New York State Forest Preserve in the Adirondacks and Catskills are examples. As centers for recreation most reserved forests receive intensive use. Not only are many of these areas good hunting, fishing and camping grounds, but they include some of the most popular areas for winter sports and some of the most scenic attractions in the country. As grazing lands, the noncommercial forests that are unproductive for timber use are used for livestock much as are commercial forest lands. Habitat and forage for wild life is another common and valuable use of the noncommercial forest lands. For example some of the higher slopes of the western mountains support mountain goats, bighorn sheep, ptarmigan, and other wildlife species. Wild life use of noncommercial forest lands is compatible with the many other uses and represents a valuable contribution to the pleasure people get from being out in remote and forested areas.

Most important of all uses of much of the noncommercial forest area is watershed use. Much of the water for agriculture in the West, and for domestic and industrial purposes both there and in other regions, originates on high mountain slopes many of which are classified as noncommercial forest land. The protective value of the chaparral type in California and in the Great Basin is far greater than the value of any trees which may grow on such areas. Likewise the effect of forest vegetation in preventing erosion and in regulating streamflow is valued

highly in many communities. All the unproductive forest is important because of its value in watershed protection.

Nonforest Land

In addition to areas that are classified as forest land, there are other areas that support tree growth, even though they are not defined as forest land. They include isolated forest areas less than 1 acre in the East or less than 10 acres in the West; tree-covered areas in thickly populated urban and suburban sections; fencerows; orchards; and roadside, streamside, shelterbelt strips less than 120 feet wide, and areas from which the forest has been removed to less than 10 percent stocking and which have been permanently developed for grazing, agricultural, residential, industrial or other uses. In the aggregate, the area of these timbered nonforest lands is probably much greater than generally realized.

THE OWNERSHIP PATTERN[3/]

The pattern of commercial forest land ownership has several distinctive characteristics (table 5 and fig. 6). Most noticeable is the fact that private ownership predominates nationally; 73 percent of all commercial forest land is in private holdings, 27 percent in public holdings. In the eastern regions the private percentage is even higher, averaging 87 percent for the North and South combined. In the West the situation is reversed because of the large acreage of national forests and other public holdings. There public ownership accounts for about two-thirds of the total; one-third is private.

Farm holdings represent the largest block of commercial forest land in private ownership. They include nearly half of all privately-owned commercial forest land in the United States and Coastal Alaska. Somewhat more than one-third is in the "other private" class. In this class are a great number of owners of various kinds. Included are the industries other than primary wood manufacturing, public utilities, various organizations, urban residents, and other individuals. In general, most farm and "other" private forest owners are not dependent, or are dependent only to a minor degree, for their livelihood on timber use. The smallest acreage in private ownership is held by the primary wood manufacturing industries. The largest percentage of forest land owned by these industries is in the West where public holdings are largest, too. They control the least land in the North, only 10 percent of the total.

Sixty-five percent of the public holdings in the United States and Coastal Alaska are in national forests. State, county, municipal and other local forest holdings make up twenty-one percent of the total, and other Federal holdings, mostly administered by the Department of the Interior, include 14 percent. National forest lands, totaling nearly 85 million acres, are distributed countrywide as

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3/ A more complete discussion of forest ownership is included in a separate report, "Ownership of Forest Land and Timber".

Table 5.--Ownership of commercial forest land, by section, 1953
(United States and Coastal Alaska)

Ownership class	United States and Coastal Alaska	Coastal Alaska	Total, United States	North	South	West
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
Private:						
Farm	165,217	..	165,217	61,394	90,143	13,680
Primary wood manufacturing	62,380	..	62,380	14,101	33,523	14,756
Other	130,672	19	130,653	66,120	52,943	11,590
Total	358,269	19	358,250	141,615	176,609	40,026
Public:						
National Forest	84,759	3,445	81,314	10,282	10,372	60,660
Other Federal	18,365	805	17,560	2,812	3,824	10,924
State and local	27,216	..	27,216	19,332	2,483	5,401
Total	130,340	4,250	126,090	32,426	16,679	76,985
All owners	488,609	4,269	484,340	174,041	193,288	117,011

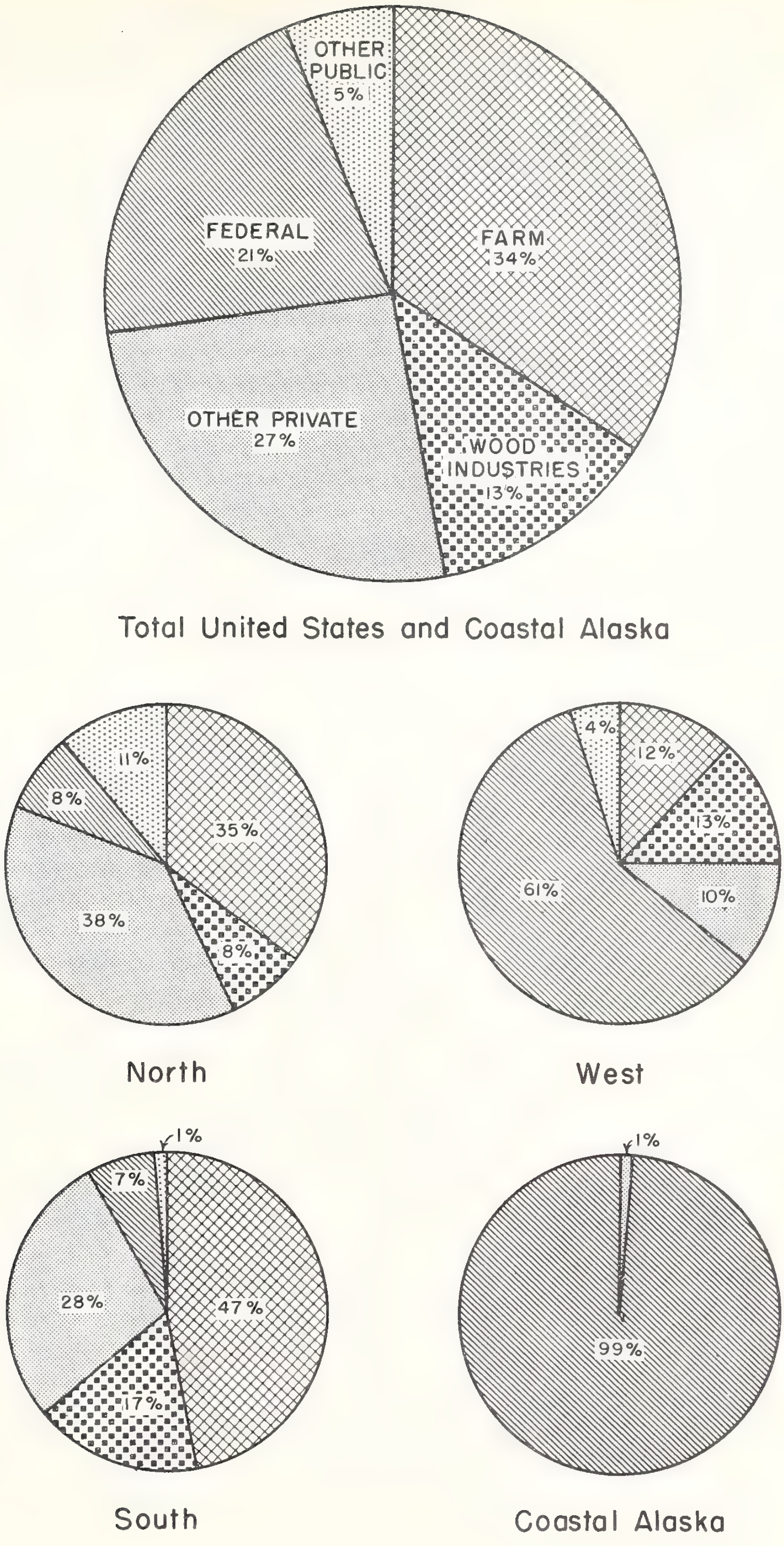

Fig. 6.— Distribution of commercial forest area by ownership class

follows: West 72 percent, South 12 percent, North 12 percent and Coastal Alaska 4 percent. State, county, and municipal lands are important segments of the ownership picture in some sections. In the North, these holdings encompass 2½ times as much land as in the South and West combined. They account for nearly two-fifths of the commercial forest land in Minnesota, about one-fifth in Michigan, Pennsylvania, and Wisconsin, and more than 10 percent in Massachusetts. Washington is the only State outside the North where more than 10 percent of the commercial forest land is owned by State and local governments. Most of the public lands in this category in the cutover counties of the Lake States were acquired through tax delinquency.

Size of private holdings, by sections of the country, shows some striking differences too (table 6). Small holdings are especially typical of the eastern regions where they account for 77 percent of all private land. In the West the percentage of large holdings is greater, amounting to 34 percent of the total, compared to 11 percent in the North, 16 percent in the South, and 16 percent nationally. As is shown in another part of this report, the distribution of private lands by size of holding is closely related to the progress and status of forestry measures.

CONDITION OF COMMERCIAL FOREST LAND

Location and ownership of commercial forest land are only part of the story. It is equally important to know something about the condition of the land. Two criteria are commonly used by foresters—the distribution of area by stand size classes and the density or stocking of timber on forest land. Where old growth remains, foresters also distinguish between old-growth and young-growth sawtimber stands.

Sawtimber and Poletimber Stands Occupy Nearly Equal Areas

Sawtimber stands, the main source of present timber supplies, and poletimber stands each occupy more than one-third of the commercial forest land. The remainder of the commercial forest land, more than one-fourth, is occupied by seedling and sapling stands or is nonstocked. However there is great variation between regions in the distribution of stand size class areas (table 7).

Sawtimber area constitutes a relatively high proportion of the commercial forest area in the West and Coastal Alaska:

	United States and Coastal Alaska (percent)	East (percent)	West (percent)	Coastal Alaska (percent)
Sawtimber stands	37	29	60	96
Poletimber stands	35	39	22	2
Other stands and nonstocked areas	28	32	18	2
Total	100	100	100	100

Table 6.--Ownership of private commercial forest land by size, class of ownership, and by section, 1953 (United States and Coastal Alaska)

Section	All holdings	Small (less than 5,000 acres)	Medium (5,000 to 50,000 acres)	Large (more than 50,000 acres)
	Thousand acres	Thousand acres	Thousand acres	Thousand acres
North	141,615	117,160	8,553	15,902
South	176,609	128,192	20,517	27,900
West	40,026	19,912	6,633	13,481
Continental United States	358,250	265,264	35,703	57,283
Coastal Alaska	19	19	..	..
All sections	358,269	265,283	35,703	57,283

Table 7.--Commercial forest area by stand-size class, and by section and region, 1953 (United States and Coastal Alaska)

Section and region	Total	Sawtimber stands	Poletimber stands	Seedling and sapling stands	Nonstocked areas[1]
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
North:					
New England	30,658	10,302	14,501	4,969	886
Middle Atlantic	42,225	15,002	16,991	8,842	1,390
Lake States	53,272	6,457	16,010	20,370	10,435
Central	42,394	14,486	15,722	8,957	3,229
Plains	5,492	1,475	2,289	1,053	675
Total	174,041	47,722	65,513	44,191	16,615
South:					
South Atlantic	46,152	16,833	18,212	9,631	1,476
Southeast	94,985	24,505	37,201	21,097	12,182
West Gulf	52,151	19,164	22,963	7,610	2,414
Total	193,288	60,502	78,376	38,338	16,072
West:					
Pacific Northwest:					
Douglas-fir subregion	25,455	14,611	4,542	4,260	2,042
Pine subregion	19,910	14,065	3,968	1,227	650
Total	45,365	28,676	8,510	5,487	2,692
California	17,317	14,038	1,122	44	2,113
Northern Rocky Mountain	33,840	15,039	11,275	4,710	2,816
Southern Rocky Mountain	20,489	12,639	4,612	1,939	1,299
Total	117,011	70,392	25,519	12,180	8,920
Continental United States	484,340	178,616	169,408	94,709	41,607
Coastal Alaska	4,269	4,092	75	75	27
All regions	488,609	182,708	169,483	94,784	41,634

1/ Including other stands that do not qualify as sawtimber, poletimber, or seedling and sapling stands. See stand-size definitions in Appendix.

Eastern forests are characterized by large acreages of poletimber, sapling, and seedling stands. Such stands, occuping 63 percent of the commercial forest land in the North and 60 percent in the South, hold promise of increasing sawtimber supplies from both of these sections in the future.

Another noticeable and significant fact relating to stand size distribution is the occurrence of nonstocked lands to about the same extent—8 to 10 percent of commercial forest area—in all sections except Alaska. Totaling some 42 million acres, this nonstocked land presently contributes little or nothing to the timber supply.

Old-Growth Sawtimber on 10 Percent of Commercial Forest Land

Of the 74 million acres of sawtimber stands in the West and Coastal Alaska, 50 million acres bear old-growth sawtimber. (Elsewhere, the old-growth area is scattered and relatively small.) While old-growth accounts for 41 percent of the commercial forest land in these two sections, nationally its area appears less important—about 10 percent of the total commercial forest area. However, in terms of timber volume, old-growth sawtimber is of great importance, both regionally and nationally. About three-fifths of the old-growth sawtimber area is in national forests; two-fifths is in private or other public ownership, as these 1953 estimates for the West and Coastal Alaska show:

Ownership class	Total commercial forest land (thousand acres)	Old-growth sawtimber (thousand acres)	Old-growth sawtimber (percent of total)
National forest	64,105	31,570	49
Other ownerships	57,175	18,414	32
Total	121,280	49,984	41

One-third, 10 million acres, of national forest old-growth is in the Pacific Northwest, and about one-tenth, 3 million acres, occurs in Coastal Alaska. The rest is distributed among national forests in other western regions—roughly 6 million acres in each Rocky Mountain region and in California. About two-thirds of the old growth in other ownerships is in the Pacific Northwest and California.

Although some of the old-growth stands are virgin timber, many of them—particularly in the ponderosa pine type—have been cut selectively. It is estimated that such cuttings have resulted in thrifty, managed stands on about one-fourth of the old-growth area in the West.

Large Share of Commercial Forest Land is Understocked

Density or degree of stocking, another criteria of the condition of forest land, indicates to what extent growing space is occupied by present or potential sawtimber or poletimber trees. Well and medium stocked stands are 40 percent or more stocked in relation to full stocking for comparable sites and stands; poorly stocked stands are 10-30 percent stocked; nonstocked areas are less than 10 percent stocked. Nonstocked areas, poorly stocked stands, and even medium stocked stands are producing timber considerably below their potential. Excluding old-growth sawtimber stands, it is estimated that 17 percent of the remaining commercial forest land is poorly stocked at the present time, and 9 percent is nonstocked (table 8).

When stocking is examined with respect to stand size, as in table 9, it is apparent that the younger stands have more than a proportionate share of poor stocking. Only 12 percent of the young-growth sawtimber area is poorly stocked, and 17 percent of the poletimber area, but 29 percent of seedling and sapling stands are in this category.

The combined acreage of poorly stocked seedling and sapling stands and nonstocked areas is 69 million acres. Most of it is in the East where two regions, the Southeast and the Lake States, account for more than half of it (fig. 7). This sizeable area of idle forest land suggests one of the more outstanding opportunities for increasing the timber supply.

TRENDS IN FOREST LAND AREA

The foregoing summarizes the information on the present forest area. What is known of area trends from previous studies needs consideration too. It is well recognized that since the first days of settlement the forest area has decreased. One estimate indicates that in 1630 the forest land area of the continental United States was 950 million acres or about one-half of the total land area of the country. Through clearing for agriculture and settlement, the forests, especially in the East, decreased until about the first part of the 20th Century. From then on the total acreage of forest land appears not to have changed appreciably.

The first nationwide estimate of forest land area using the general terminology and broad concepts of the present day was made in 1920. Including this estimate and subsequent ones, there have been five national reports summarizing forest areas in the continental United States:

Table 8.--Area and stocking of young-growth stands and nonstocked areas on commercial forest land, by section and region, 1953 (United States and Coastal Alaska)

Section and region	Total[1/]	Well or medium stocked		Poorly stocked		Nonstocked	
	Thousand acres	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent
North:							
New England	30,658	27,555	90	2,217	7	886	3
Middle Atlantic	42,225	36,005	85	4,830	12	1,390	3
Lake States	53,272	26,723	50	16,114	30	10,435	20
Central	42,394	34,321	81	4,844	11	3,229	8
Plains	5,467	2,237	41	2,555	47	675	12
Total	174,016	126,841	73	30,560	18	16,615	9
South:							
South Atlantic	46,152	40,245	87	4,431	10	1,476	3
Southeast	94,985	65,898	69	16,905	18	12,182	13
West Gulf	52,151	43,540	83	6,197	12	2,414	5
Total	193,288	149,683	78	27,533	14	16,072	8
West:							
Pacific Northwest:							
Douglas-fir subregion	17,987	14,031	78	1,914	11	2,042	11
Pine subregion	10,000	7,638	76	1,712	17	650	7
Total	27,987	21,669	77	3,626	13	2,692	10
California	6,077	2,540	42	1,424	23	2,113	35
Northern Rocky Mountain	24,667	15,686	64	6,165	25	2,816	11
Southern Rocky Mountain	12,250	7,557	62	3,394	28	1,299	10
Total	70,981	47,452	67	14,609	21	8,920	12
Continental United States	438,285	323,976	74	72,702	17	41,607	9
Coastal Alaska	315	279	88	9	3	27	9
All regions	438,600	324,255	74	72,711	17	41,634	9

1/ Excluding 50,009,000 acres of old-growth sawtimber stands.

Table 9.--Area and stocking of young-growth stands on commercial forest land, by stand size class, 1953 (United States and Coastal Alaska)

Stand size class	Total 1/	Well and medium stocked	Poorly stocked	Non-stocked
	Thousand acres	Thousand acres	Thousand acres	Thousand acres
Sawtimber stands	132,699	116,748	15,951	..
Poletimber stands	169,483	139,992	29,491	..
Seedling and sapling stands	94,784	67,515	27,269	..
Nonstocked area	41,634	..	..	41,634
Total	438,600	324,255	72,711	41,634

1/ Excluding 50,009,000 acres of old-growth sawtimber stands where stocking was not measured.

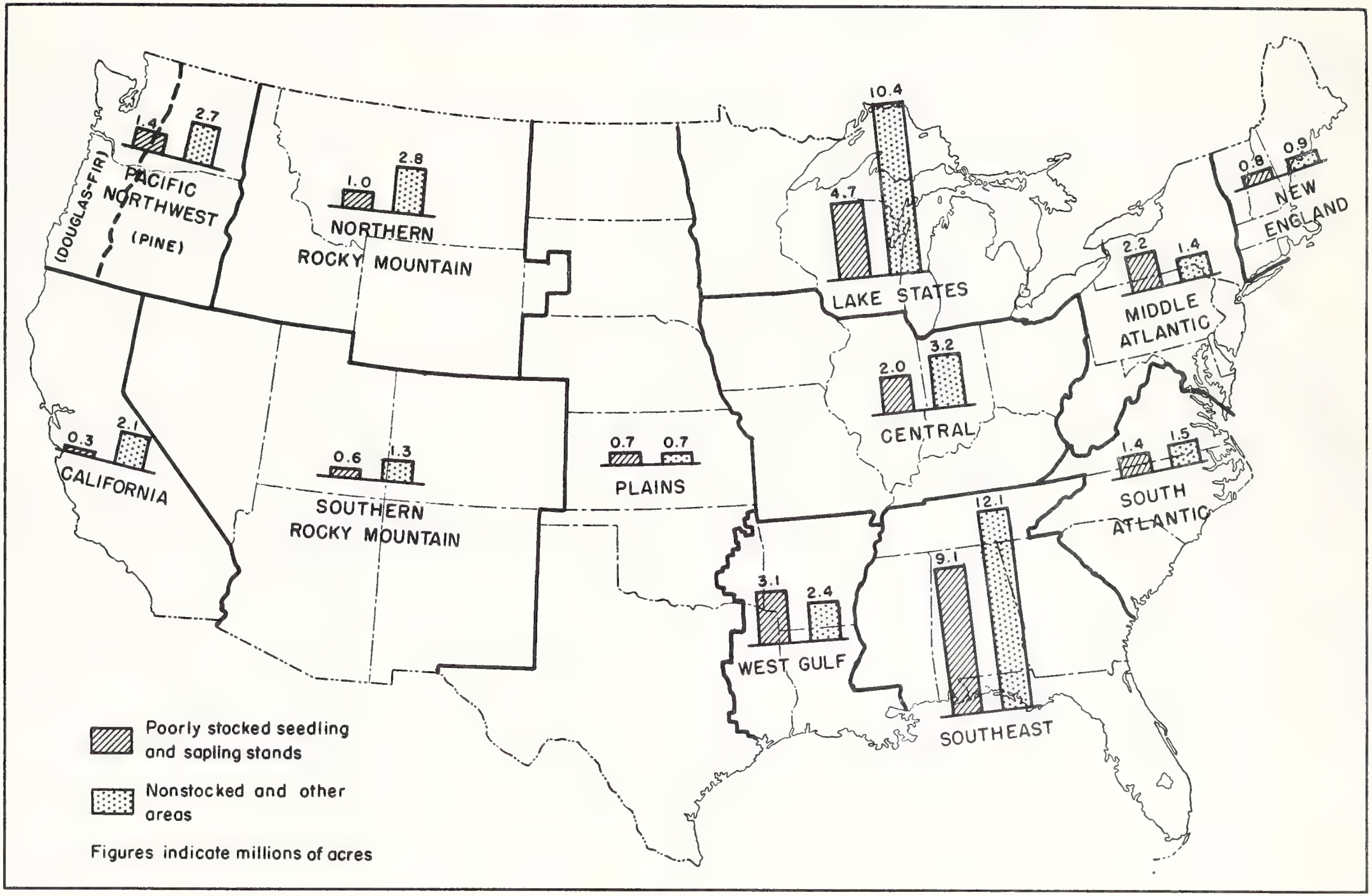

Fig. 7.— Understocking is more serious in the East

Year of estimate[1]	Total forest land area (million acres)	Commercial forest land area (million acres)	Noncommercial forest land area (million acres)
1630	950	850	100
1920	614	464	150
1930	615	495	120
1938	630	462	168
1945	624	461	163
1953	647	484	163

1/ The sources of published data are as follows:

1630 - Kellogg, R. S. U. S. Dept. Agr., Forest Serv., Cir. 97, 16 pp., illus. 1907.
1920 - U. S. Dept. Agr., Forest Serv. Timber Depletion, Lumber Prices, Lumber Exports, and Concentration of Timber Ownership. Rpt. on Sen. Res. 311. 66th Cong., 2d Sess., 73 pp., illus. (Capper Rpt.) Wash., D. C., 1928.
1930 - U. S. Dept. Agr., Forest Serv. A National Plan for American Forestry. Sen. Doc. 12, 73d Cong., 1st Sess., 2 Vols., 1677 pp., illus. (Copeland Rpt.) Wash., D. C., 1933.
1938 - Cong. U. S., Joint Committee on Forestry. Forest Lands of the United States. Sen. Doc. 32, 77th Cong., 1st Sess., 44 pp. illus. (J. C. C. Rpt.) Wash., D. C., 1941.
1945 - U. S. Dept. Agr., Forest Serv. Forests and National Prosperity. Misc. Pub. 668, 99 pp., illus. (Reappraisal Rpt.), 1948.

The forest area data in the 1920, 1932, and 1938 national reports were compilations based on field surveys in limited areas and estimates for the remaining area. Since 1938 the area data take on added reliability because of the progress in the nationwide forest inventory project. By 1945 the project had covered by systematic surveys about half of the commercial forest area and by 1953, 86 percent of the area. Thus, data for 1945 and 1953 have a much greater reliability than those in the previous reports.

Forest Land Area Gains Since 1945

In the 8 years between 1945 and 1953 the estimate of total forest land area increased 23.8 million acres; of this difference, 23.3 million acres are classed as commercial and 0.5 million as noncommercial forest land. The difference is attributable to two factors, changes in land use and improved accuracy of area estimates.

In all sections of the country there have been sizable changes in commercial forest area. The largest increase was in the South where over 10 million acres of agricultural land were added to the commercial forest area. Almost as many acres were added to the estimate of commercial forest area in the West when major shifts from the noncommercial to the commercial class were made in the estimates for the Rocky Mountain States. In the North nearly 4 million acres were added mainly by reclassifying forested swamps and poor aspen sites and by more accurate area determinations in the Plains States.

Although the noncommercial forest area in 1953 was about the same as in 1945, there were some rather large shifts in a few regions. In the West, the estimate of noncommercial forest area increased 6.8 million acres. In the Southern Rocky Mountain Region, over 12 million acres were added by including hardwood and pinyon pine-juniper types once considered as nonforest. Half of this increase was offset by reductions in noncommercial area in California and the Northern Rocky Mountain Region. In the North the noncommercial forest area estimate decreased in the Lake States and Plains regions by transfers to the commercial category. Changes of noncommercial area in the South were minor.

In addition to the above explanations there were shifts resulting from clearing land for reservoir sites, parks, rights-of-way and other urban uses. For these new uses, some 2 million acres were deducted from the commercial forest area since 1945. On the other hand, somewhat over 600,000 acres were added by the release of military reservations, municipal watersheds, parks, and reserved national forest lands.

Timber Use Competes with Other Land Uses

As the national economy expands, competition for the use of land will inevitably increase. In the past the acreage of commercial forest land has been affected chiefly by competition from agriculture. However, other non-timber uses also can be expected to have an important effect on the acreage used for timber production in the future.

In 1952, some 3.3 million acres of commercial forest land were cut with definite intent of conversion from forest to other land use. Since about 90 percent of this acreage was in small private holdings in the East, most of it was probably cleared for agriculture. However, the acreage of marginal farm land returned to forest more than offset the acreage cleared, as it has for the last 50 years.

This shifting of land use between forestry and agriculture began in colonial times. Until the opening of the 20th century, clearing for farm use resulted in a steady decline in forest area, but for the last several decades the area returned to forest has exceeded the area cleared. The change in trend has been due to a number of changes in agriculture. In the latter half of the 19th century, the great westward flow of population from New England and other eastern regions to the Prairie States and the nonforest and agricultural lands in the West released millions of eastern acres which had been farmed. The westward migration was still

in progress when the advent of the automobile and then the gasoline tractor released millions of additional acres that had been needed to provide feed for horses. In the South the boll-weevil and economic problems in cotton farming also resulted in large acreages of abandoned farm land. Other substantial areas in the cutover counties of the Lake States proved uneconomic for farming and were abandoned during the last few decades.

This great readjustment in the area devoted to crops and pastures has about run its course in the North. It has probably passed its peak in the South. And in the West it has never been more than of local importance. It is unlikely that there will be any comparable downward adjustment in agricultural acreage in the future. Rather, some loss of forest area to agriculture seems likely, even though technological and economic factors are still tending to concentrate agricultural production on the better lands and to free poorer lands for forestry.

In the shifting of land between forestry and other uses another important factor is the increasing management of land for water. The need to plant critical areas for watershed protection and erosion prevention is tending to make more land available for timber growing. Since most watershed lands may be successfully managed for timber production without impairment of the water supply, conservation and watershed surveys in most agricultural areas reveal a sizable acreage which, because of steepness, susceptibility to erosion or other reasons, can be handled best by conversion to forest cover. Working in the opposite direction is the reservation of municipal watershed land exclusively for protection of the water supplies, and the inundation of commercial forest land by new reservoir construction.

The area available for timber growing is being steadily reduced by urban and industrial development. Not only is the urban population growing in numbers, but the current trend toward suburban living is increasing per capita space requirements. Similarly the requirements for industrial growth are magnified by the current trend toward decentralization, with one-story plant layouts and ample space for parking of employees' cars and for expansion.

Rights-of-way for highways, pipelines, powerlines and communication lines also encroach upon the area available for timber growing. The construction of new superhighways is of increasing importance in this category, while use of radio tends to reduce further demands for communication lines. All together such special uses may require more new land than urban and industrial expansion with which they are associated.

Setting aside of forest land for recreational use is more likely to be of importance than any of the factors mentioned except clearing for agriculture though not all such use requires curtailment of other uses. Nevertheless the pressing need for development of recreational areas will be met by withdrawing a certain acreage of forest land from commercial use. Recreational facilities in national forests, national parks, and other public forest lands need to be greatly expanded to meet growing demands. Along with such reservations is the growing demand for the reservation of strips of timber along forest highways.

The acreage devoted to timber growing in the future will reflect the give and take of competition with agriculture, water, recreation, and other land uses. However it seems likely that the upswing in forest area which started about 1910 has run its course and that the underlying and historic downward trend will soon be resumed.

TIMBER VOLUME

In contrast to the foregoing discussion of forest land which called attention to the long-run timber supply situation, the following discussion is concerned primarily with the timber resource now available. In appraising this resource, important considerations include the regional distribution of the timber, and its species composition, quality, ownership and accessibility. Such an appraisal places emphasis on the volume of standing timber on commercial forest land; the timber on noncommercial forest land and on nonforest land is of minor importance.

VOLUME ON COMMERCIAL FOREST LAND

For the rest of this century, almost all of the nation's domestic wood supply will be harvested from trees that are now growing on the commercial forest land. As of the beginning of 1953, these trees contained more than 600 billion cubic feet of sound wood (table 10). Of this, 86 percent, or 517 million cubic feet, is classified as forest growing stock. The balance, 14 percent, includes the sound volume of cull trees, salvable dead trees and hardwood limbs.

The forest growing stock is the significant portion of the timber resource. Nearly three-fourths of it is in sawtimber trees; the other fourth is in poletimber trees--smaller trees which may become sawtimber trees in the future.

The total net volume of sawtimber on commercial forest land amounts to 2,094 billion board feet, measured according to the International 1/4-inch log rule. All of it is contained in the sawlog portions of sawtimber trees--2,057 billion board feet in live sawtimber trees and 37 billion board feet in salvable dead sawtimber trees. Rot and other defects are excluded from both of these estimates. Softwood species account for four-fifths of the total sawtimber volume; one-fifth is hardwood. Since live sawtimber comprises the bulk of the timber that is suitable for lumber and most other present uses, this discussion of the timber resource emphasizes the board-foot estimates of sawtimber volume.

Two-thirds of Sawtimber Volume is in the West

Two-thirds of all the live sawtimber in the United States and Coastal Alaska is in the four western regions where it is remote from consumers, more than four-fifths of whom live in the East (table 11 and fig.8). Coastal Alaska, generally thought of as a large reservoir of softwood timber, has about 89 billion board feet, or only 4 percent of the total. The balance is in the East, 17 percent in the South and 13 per-

Table 10.--Net volume of all timber and sawtimber on commercial forest land, by class of material, softwood and hardwood, January 1, 1953
(United States and Coastal Alaska)

ALL TIMBER

Class of material	Total		Softwood	Hardwood
	Billion cu. ft.	Percent	Billion cu. ft.	Billion cu. ft.
Growing stock:				
Live sawtimber trees:1/				
Sawlog portions	331	55	262	69
Upper stems	48	8	29	19
Total	379	63	291	88
Live poletimber trees2/	138	23	64	74
Total, growing stock	517	86	355	162
Cull trees	56	9	18	38
Salvable dead trees:				
Sawtimber trees1/	8	1	7	1
Poletimber trees2/	1	(4/)	1	(3/)
Hardwood limbs	23	4	..	23
Total, all timber	605	100	381	224
	Percent		Percent	Percent
Percent of total	100	..	63	37

SAWTIMBER5/

Class of material	Total		Softwood	Hardwood
	Billion bd. ft.	Percent	Billion bd. ft.	Billion bd. ft.
Live sawtimber trees1/	2,057	98	1,648	409
Salvable dead sawtimber trees1/	37	2	34	3
Total, sawtimber volume	2,094	100	1,682	412
	Percent		Percent	Percent
Percent of total	100	..	80	20

1/ Trees of commercial species that contain at least one merchantable sawlog as defined by regional practice and which are of the following minimum diameters at breast height: Eastern regions: Softwoods 9.0 inches, hardwoods 11.0 inches. Western regions: All species 11.0 inches.

2/ Trees of commercial species which meet regional specifications of soundness and form, and which are of the following diameters at breast height: Eastern regions: Softwoods 5.0 to 9.0 inches, hardwoods 5.0 to 11.0 inches. Western regions: All species 5.0 to 11.0 inches.

3/ Less than 500 million cubic feet.

4/ Less than 0.5 percent.

5/ Included in all-timber cubic volume but also measured in board feet.

Table 11.--Regional distribution of live sawtimber volume and growing stock on commercial forest land, softwood and hardwood, 1953 (United States and Coastal Alaska)

Section and region	Sawtimber 1/			Growing stock		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.
North:						
New England	51	27	24	24	10	14
Middle Atlantic	74	13	61	34	5	29
Lake States	50	14	36	25	7	18
Central	83	4	79	25	1	24
Plains	8	1	7	3	(3/)	3
Total	266	59	207	111	23	88
South:						
South Atlantic	107	51	56	34	15	19
Southeast	139	77	62	48	23	25
West Gulf	111	55	56	32	13	19
Total	357	183	174	114	51	63
West:						
Pacific Northwest:						
Douglas-fir subregion	595	577	18	113	107	6
Pine subregion	154	154	(2/)	33	33	(3/)
Total	749	731	18	146	140	6
California	360	354	6	67	64	3
Northern Rocky Mountain	167	166	1	43	43	(3/)
Southern Rocky Mountain	69	66	3	18	16	2
Total	1,345	1,317	28	274	263	11
Continental United States	1,968	1,559	409	499	337	162
Coastal Alaska	89	89	(2/)	18	18	(3/)
All regions	2,057	1,648	409	517	355	162

1/ In addition to the live sawtimber volume, there are 37 billion board feet of sawtimber in salvable dead trees; of this total 34 billion board feet are in the West, 2 billion in the North, 1 billion in the South.

2/ Less than 0.5 billion board feet.

3/ Less than 0.5 billion cubic feet.

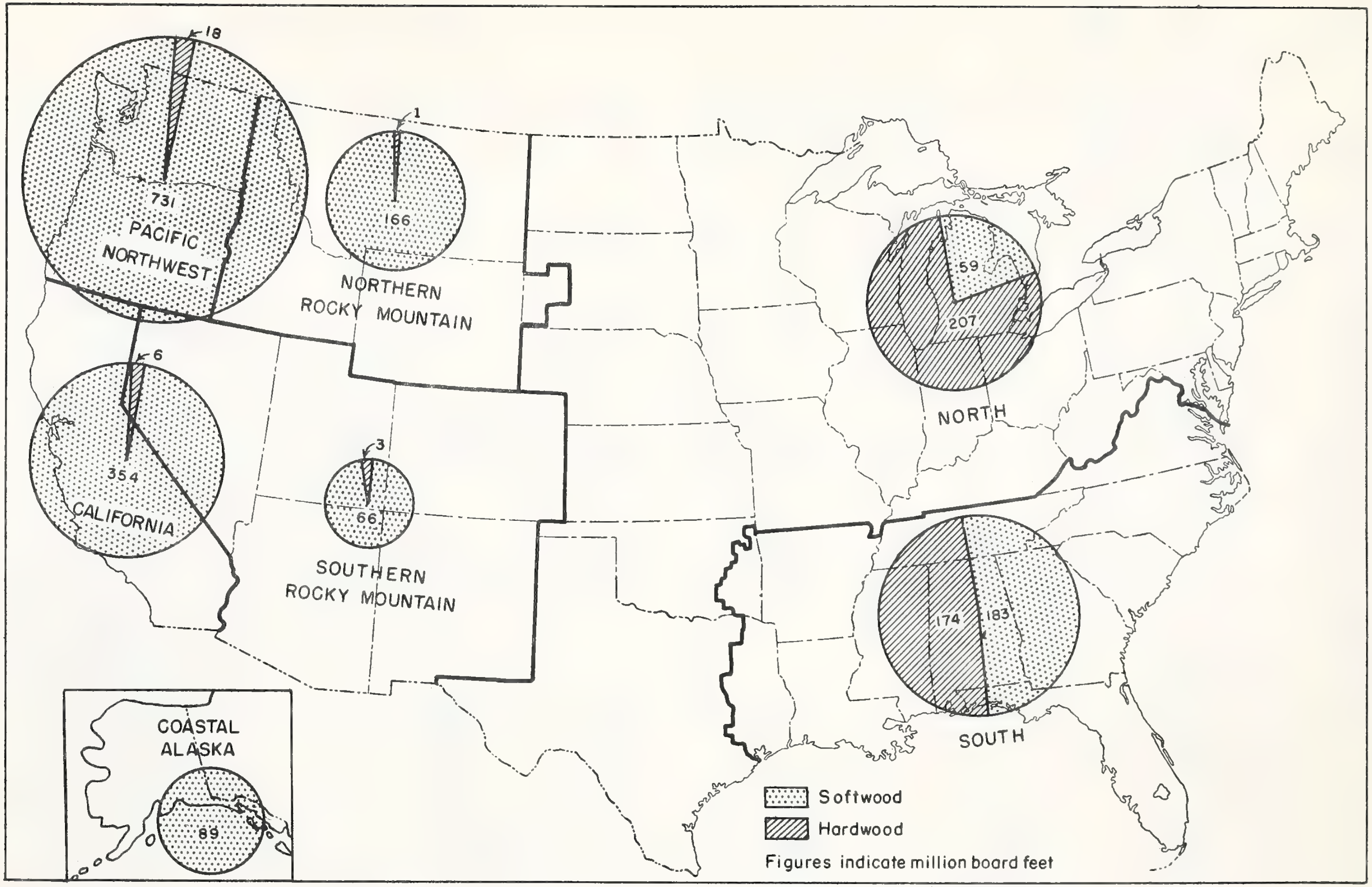

Fig. 8.— Two-thirds of the sawtimber volume is located in the West, nearly two-fifths in the Pacific Northwest alone.

cent in the North. Three States—Oregon, Washington, and California—contain 55 percent of all the sawtimber volume, a characteristic of the sawtimber supply which has resulted in a heavy concentration of lumber industry capacity in the Pacific Coast States (table 12).

From region to region the volume of sawtimber varies considerably. For example, the average volume of sawtimber per acre of commercial forest land in the West is 11,500 board feet, in California it is 20,800 board feet, and in the adjacent Southern Rocky Mountain Region, 3,400 board feet. Likewise, in the East where the average volume per acre is 1,700 board feet, the average is 900 board feet in the Lake States and 2,300 board feet in the South Atlantic States. Such wide ranges in volume per acre affect the economic prospects of the dependent forest industries. They also emphasize the wide range in timber values found on the forest land.

The growing stock is more evenly distributed; 53 percent is in the West and 3 percent occurs in Coastal Alaska. The remainder, 44 percent, is in the East. However, there is wide regional variation too. For example, the 17 million acres of commercial forest land in California carry over 2½ times the growing stock volume found on 53 million acres in the Lake States. The volume of growing stock in the Douglas-fir subregion, alone, nearly equals the total found in the entire East. For optimum growth, the level of growing stock in the East is far too low.

Softwood Species Comprise Four-fifths of Sawtimber Volume

Softwood trees account for 80 percent of the nation's sawtimber volume; the balance is in hardwood trees (table 13). Nationally, Douglas-fir is the most abundant species and is identified with one-fourth of the total sawtimber volume. Except in the Southern Rocky Mountain Region, Douglas-fir is the major species throughout the West (fig. 9 and table 14). It accounts for half of the sawtimber volume in the Pacific Northwest, one-third in California, and more than one-fourth in the Northern Rocky Mountain Region. Ponderosa pine is also an abundant western species, though exceeded by western hemlock in the Pacific Northwest and by the true firs in California. Although not widely distributed, western white pine in the Inland Empire and redwood in California are of considerable importance in the West's timber economy because of their high value and specialty uses.

The commercial forests of Coastal Alaska are nearly all softwood, principally Sitka spruce and western hemlock (fig. 10 and table 15). Less than one percent of their sawtimber volume is hardwood.

The North is hardwood country (fig. 11 and table 16). Nearly four-fifths of its sawtimber volume is in hardwood trees and its stands carry half of all the hardwood sawtimber in the country. The forests of the Central States Region, with sizable volumes of oak and hickory, are more than 95 percent hardwood. New England forests, with high proportions of spruce, balsam fir, and white pine, are only 47 percent hardwood.

Table 12.—Net volume of live sawtimber and growing stock on commercial forest land, by section, region, and State, 1953 (United States and Coastal Alaska)

Section, region, and State	Sawtimber	Growing stock
	Million bd. ft.	Million cu. ft.
North:		
New England:		
Connecticut	1,859	1,304
Maine	28,226	12,601
Massachusetts	2.659	1,871
New Hampshire	10,069	4,452
Rhode Island	165	161
Vermont	8,547	3,956
Total	51,525	24,345
Middle Atlantic:		
Delaware	1,234	464
Maryland	6,771	2,899
New Jersey	1,660	952
New York	26,883	11,675
Pennsylvania	19,306	10,629
West Virginia	18,497	7,864
Total	74,351	34,483
Lake States:		
Michigan	21,141	9,912
Minnesota	12,538	7,235
Wisconsin	16,111	8,071
Total	49,790	25,218
Central:		
Illinois	11,694	3,050
Indiana	11,671	3,041
Iowa	4,119	1,183
Kentucky	27,342	7,834
Missouri	13,195	5,503
Ohio	14,650	4,013
Total	82,671	24,624

Table 12.--Net volume of live sawtimber and growing stock on commercial forest land, by section, region, and State, 1953 (United States and Coastal Alaska) - continued

Section, region, and State	Sawtimber	Growing stock
	Million bd. ft.	Million cu. ft.
North:-cont'd.		
Plains:		
Kansas	3,371	954
Nebraska	1,253	462
North Dakota	653	251
Oklahoma (west)	880	337
South Dakota (east)	790	601
Texas (west)	730	223
Total	7,677	2,828
Total, North	266,014	111,498
South:		
South Atlantic:		
North Carolina	44,152	13,642
South Carolina	32,299	9,613
Virginia	30,407	10,503
Total	106,858	33,758
Southeast:		
Alabama	38,211	11,713
Florida	23,032	8,152
Georgia	36,920	12,692
Mississippi	25,789	9,628
Tennessee	15,350	5,770
Total	139,302	47,955
West Gulf:		
Arkansas	38,317	11,762
Louisiana	41,436	11,199
Oklahoma (east)	5,580	1,780
Texas (east)	25,575	7,247
Total	110,908	31,988
Total, South	357,068	113,701

Table 12.—Net volume of live sawtimber and growing stock on commercial forest land, by section, region, and State, 1953 (United States and Coastal Alaska) - continued

Section, region, and State	Sawtimber	Growing stock
	Million bd. ft.	Million cu. ft.
West:		
Pacific Northwest:		
Douglas-fir subregion	594,375	113,171
Pine subregion	154,501	33,023
Total	748,876	146,194
Oregon	433,809	80,973
Washington	315,067	65,221
Total	748,876	146,194
California:	360,001	66,711
Northern Rocky Mountain:		
Idaho	96,015	21,246
Montana	55,770	16,143
South Dakota (west)	3,167	1,287
Wyoming	12,070	4,087
Total	167,022	42,763
Southern Rocky Mountain:		
Arizona	19,988	3,700
Colorado	25,394	8.037
Nevada	572	151
New Mexico	15,054	3,683
Utah	7,800	2,001
Total	68,808	17,572
Total, West	1,344,707	273,240
Continental United States	1,967,789	498,439
Coastal Alaska	89,058	18,496
All regions	2,056,847	516,935

Table 13.--Net volume of live sawtimber and growing stock on commercial forest land, by species group, 1953[1]

(United States and Coastal Alaska)

Species	Sawtimber	Growing stock
	Billion bd. ft.	Billion cu. ft.
Eastern softwoods:		
Southern yellow pine	174	49
Spruce and balsam fir	19	8
White and red pine	17	5
Cypress	13	4
Hemlock	12	4
Jack pine	2	1
Other	5	3
Total	242	74
Eastern hardwoods:		
White oak[2]	35)	
Red oak[3]	31)	53
Other oaks	80)	
Beech, yellow birch, and sugar maple	51	19
Sweetgum	26	9
Tupelo and blackgum	25	9
Hickory	24	9
Yellow-poplar	16	5
Cottonwood and aspen	9	8
Other	84	39
Total	381	151
Total, eastern species	623	225
Western softwoods:		
Douglas-fir	532	98
Ponderosa and Jeffrey pine	224	43
Western hemlock and Sitka spruce	208	43
True firs	184	38
Sugar and western white pine	57	10
Engelmann and other spruce	37	8
Redwood	36	6
Lodgepole pine	30	15
Western larch	28	5
Other	70	15
Total	1,406	281
Western hardwoods:		
Cottonwood and aspen	4	2
Red alder	9	4
Other	15	5
Total	28	11
Total, western species	1,434	292
Total, all species	2,057	517

1/ Species volumes by states are given in the Appendix.
2/ *Quercus alba* and *Q. pinus*.
3/ *Quercus borealis*, *Q. falcata* var. *pagodaefolia*, and *Q. shumardii*.

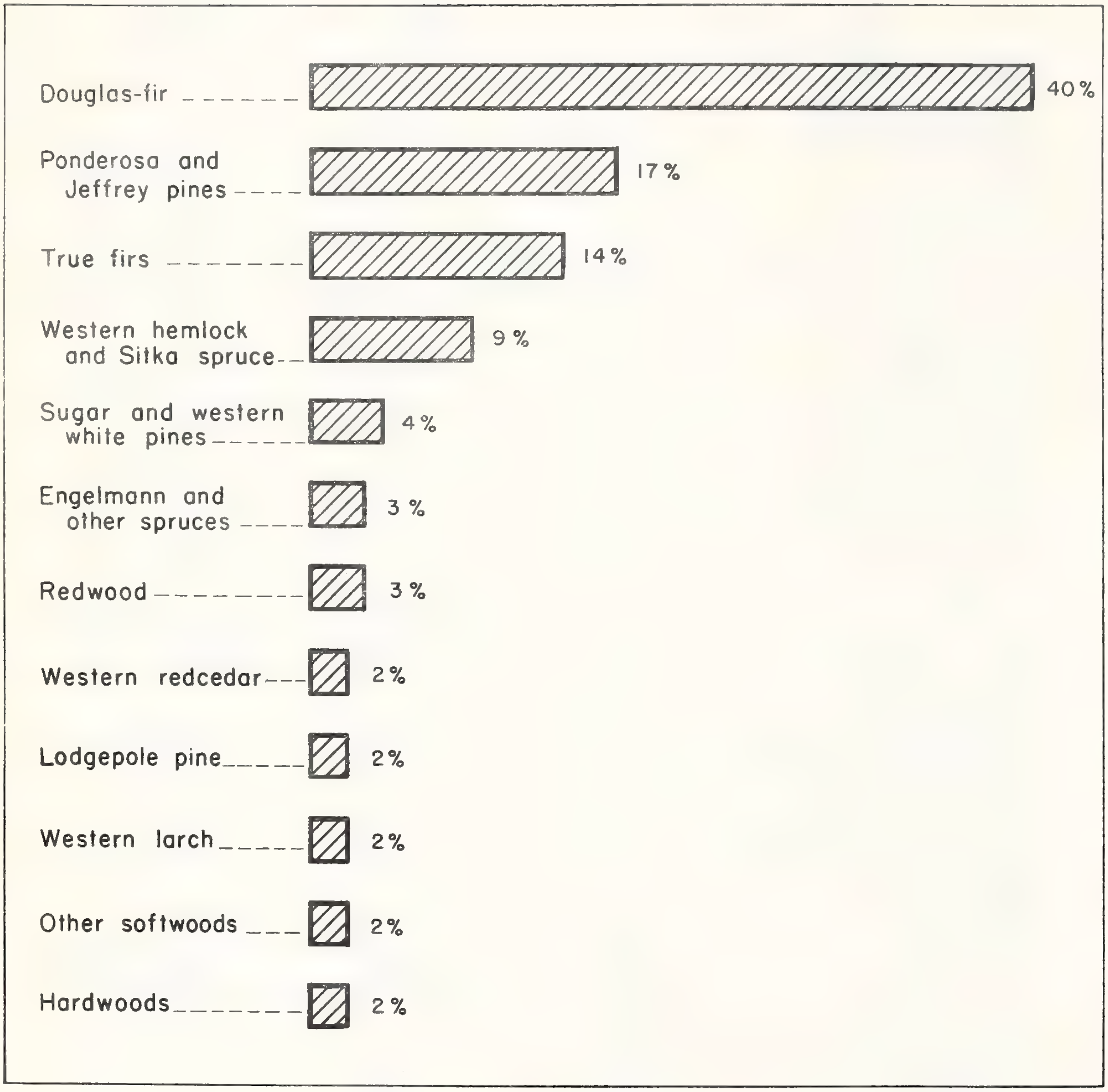

Fig. 9 - Distribution of sawtimber volume by species group, West, 1953

Table 14.--Net volume of live sawtimber by species group, West, 1953

Species	Volume	
	Billion bd. ft.	Percent
Softwoods:		
Douglas-fir	532	40
Ponderosa and Jeffrey pine	224	17
True firs	184	14
Western hemlock and Sitka spruce	127	9
Sugar and western white pine	57	4
Engelmann and other spruces	37	3
Redwood	36	3
Western redcedar	32	2
Lodgepole pine	30	2
Western larch	28	2
Other softwoods	30	2
Total softwoods	1,317	98
Hardwoods	28	2
Total, all species	1,345	100

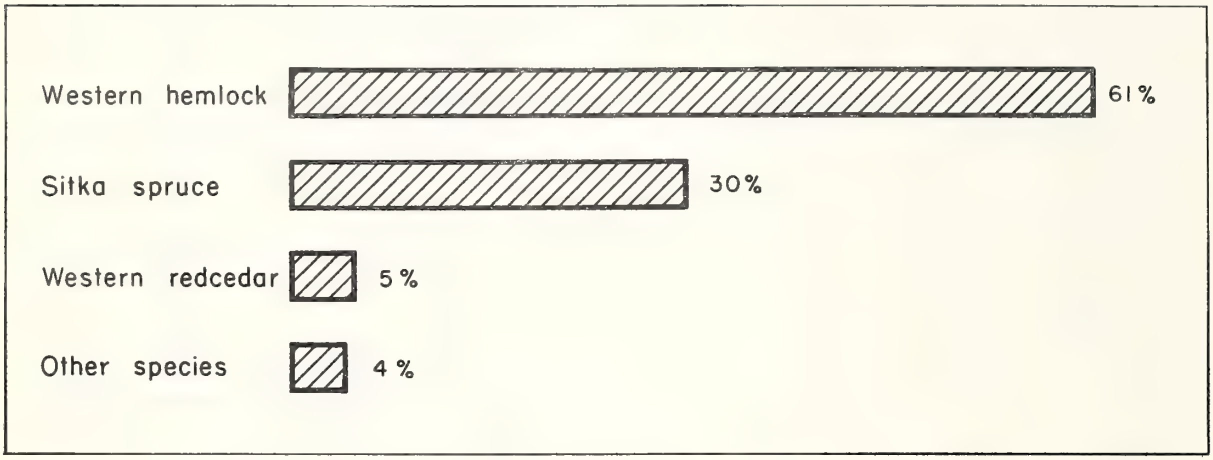

Fig. 10 - Distribution of sawtimber volume by species group, Coastal Alaska, 1953

Table 15.—Net volume of live sawtimber, by species group, Coastal Alaska, 1953

Species	Volume	
	Billion bd. ft.	Percent
Softwood:		
Western hemlock	54	61
Sitka spruce	27	30
Western redcedar	5	5
Other softwood	3	4
Total softwood	89	100
Hardwood	(1/)	(2/)
Total, all species	89	100

1/ Less than 500,000 million board feet.

2/ Less than 0.5 percent.

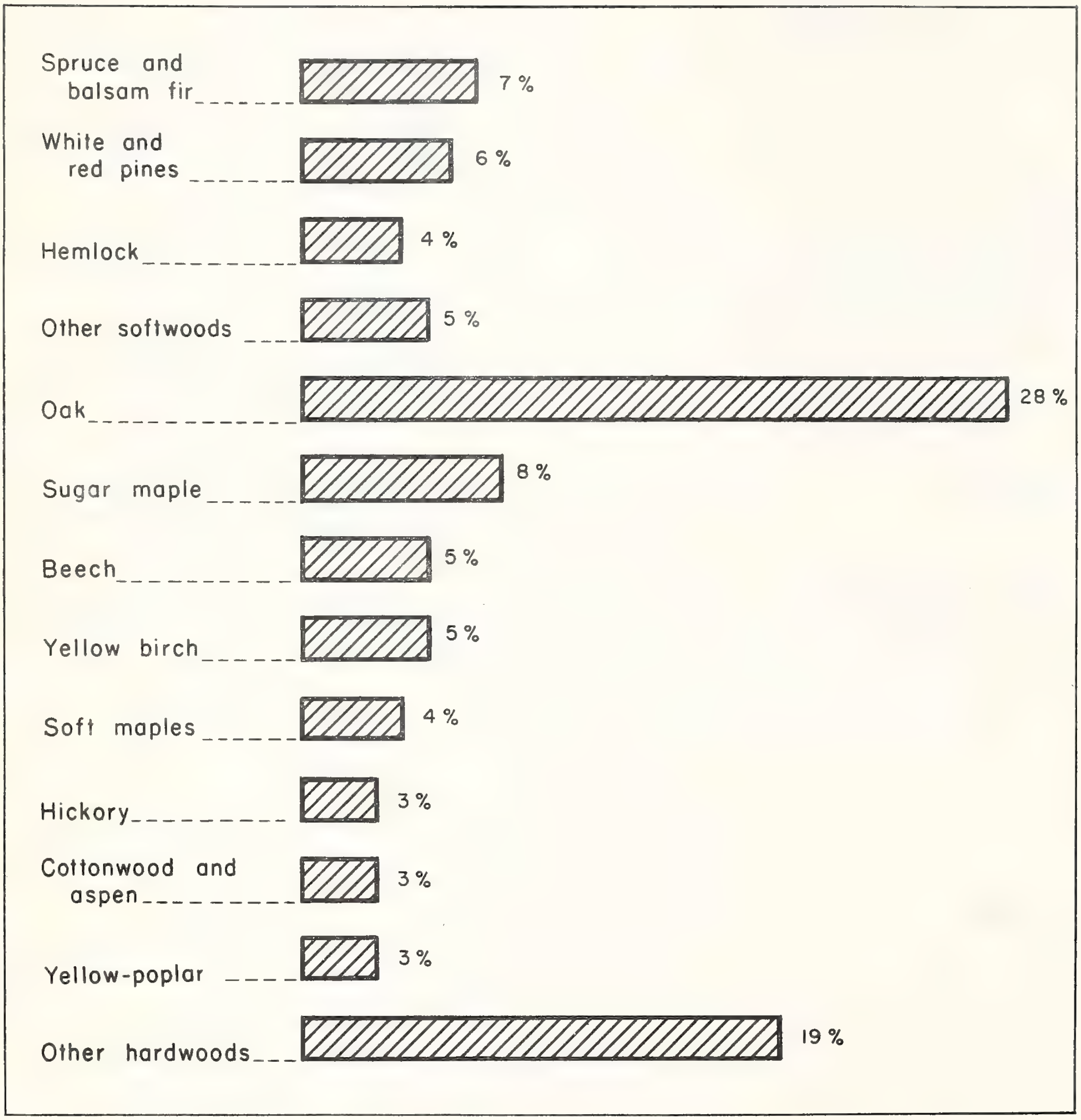

Fig. 11 - Distribution of sawtimber volume by species group, North, 1953

Table 16.--Net volume of live sawtimber, by species group, North, 1953

Species	Volume: Billion bd. ft.	Volume: Percent
Softwoods:		
Spruce and balsam fir	19	7
White and red pine	16	6
Hemlock	11	4
Other Softwoods 1/	13	5
Total softwoods	59	22
Hardwoods:		
Oak:		
Red oak 2/	23	9
White oak 3/	21	8
Other red oak	20	7
Other white oak	11	4
Total	75	28
Sugar maple	22	8
Beech	13	5
Yellow birch	12	5
Soft maples	10	4
Hickory	9	3
Cottonwood and aspen	8	3
Yellow-poplar	7	3
Other hardwoods	51	19
Total hardwoods	207	78
Total, all species	266	100

1/ Including 294 million board feet of ponderosa pine in the Plains Region.

2/ *Quercus alba* and *Q. prinus*.

3/ *Quercus borealis*, *Q. Falcata* var. *pagodaefolia*, and *Q. shumardii*.

In the three southern regions, the volumes of softwood and hardwood sawtimber are nearly equal. Almost all of the softwood is in the four important southern yellow pines--longleaf, slash, loblolly, and shortleaf pine (fig. 12 and table 17). Longleaf and slash pines predominate in the Southeast, while loblolly and shortleaf pines are widely distributed throughout the South. Cypress--most of it in the Southeast Region--is the only other southern softwood of note. More than two-fifths of the nation's hardwood sawtimber is in the South.

For commercial use, all sawtimber species are not equally valuable. More than 80 percent of the lumber produced in recent years is sawed from some 10 species, yet these species represent only about 65 percent of the sawtimber volume. Most softwood species enjoy wide acceptance, but some, such as the true firs and western hemlock, though relatively abundant, are in less demand than species like white pine and redwood which are less plentiful.

Because there are many species, widely scattered, the preferences for hardwoods are difficult to generalize. Among the oaks, white oak and red oak are highly esteemed, but "other red oaks" and "other white oaks" are often difficult to market. For many purposes consumers prefer sweetgum to tupelo and blackgum, sugar maple to soft maple; yellow birch to beech; black walnut, ash, and yellow poplar to hickory, cottonwood, and aspen. For certain special uses there are long-standing species preferences: white hickory handles, paper birch turning squares, white oak staves, birdseye maple veneers, and so on. While one softwood species can be substituted for another in many cases, without much effect on costs, the substitution of one hardwood for another is frequently more expensive and less satisfactory because of the wide variation in wood characteristics and the specialized nature of so many hardwood uses. Thus, in gauging the hardwood sawtimber supply, an important factor is consumers' preference for particular species.

Growing stock is the volume of sound wood in all trees in the 6-inch diameter class or larger that are now or prospectively suitable for conversion into merchantable forest products. Of the total growing stock, softwood species account for 69 percent, and 31 percent is hardwood. Douglas-fir, oak, and southern yellow pine are the most abundant species, but, as with sawtimber, the species composition of the growing stock shows great variation. In the West, and in Coastal Alaska, softwood species make up almost all of the growing stock, but, in the East, two-thirds of the growing stock is hardwood.

Nearly 10 Percent of Sound Timber Volume is in Cull Trees

Of the 605 billion cubic feet of timber in the United States and Coastal Alaska, cull trees, salvable dead trees and hardwood limbs account for 14 percent, none of it growing stock. In hardwoods the proportion is even higher, amounting to 28 percent of the total cubic volume of hardwood timber. A little of this material is finding its way into markets and in the East, for example, some cull trees are now used for pulpwood. In the West, salvable dead trees, including windthrown, fire-and insect-killed trees, are logged for both lumber and pulpwood.

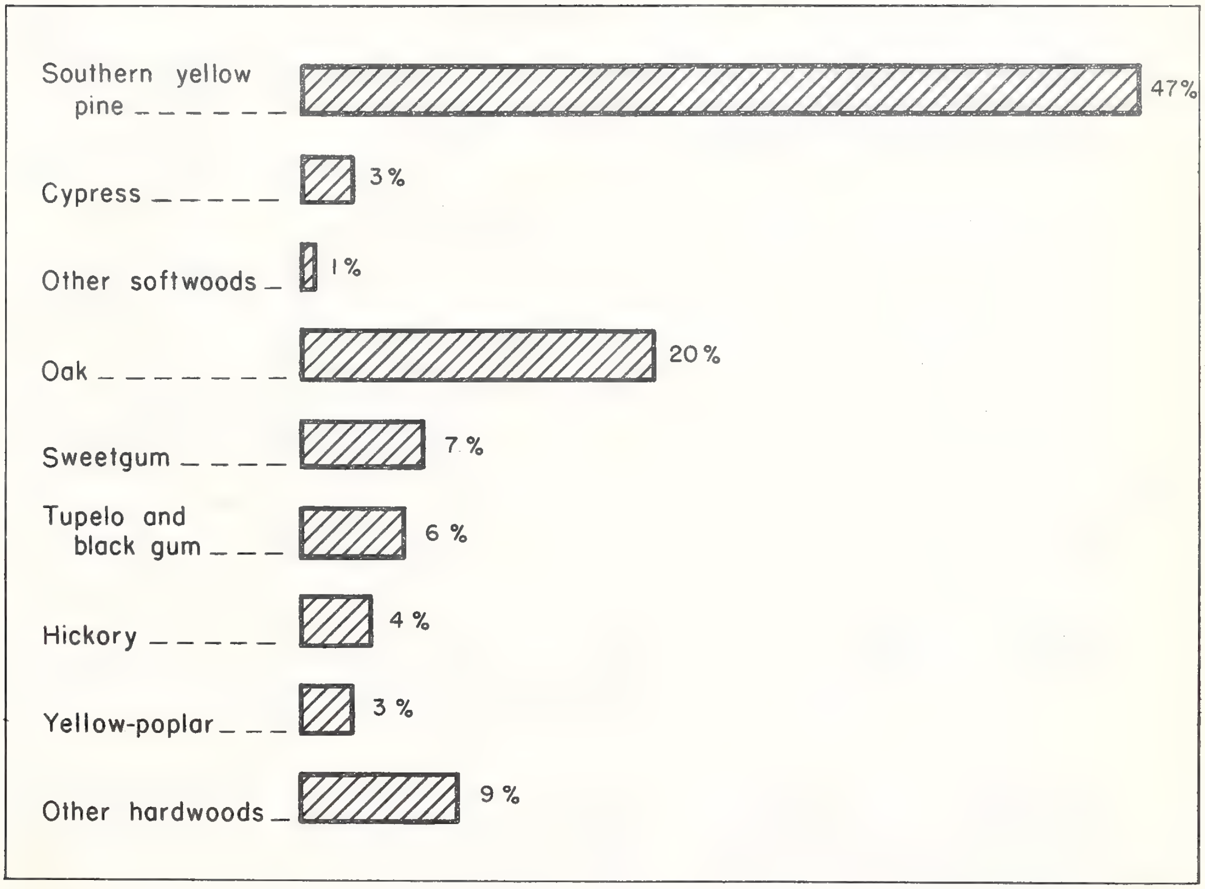

Fig. 12 - Distribution of sawtimber volume by species group, South, 1953

Table 17.--Net volume of live sawtimber, by species groups, South, 1953

Species	Volume	
	Billion bd. ft.	Percent
Softwoods:		
Southern yellow pine:		
Shortleaf and loblolly pine	121	34
Longleaf and slash pine	37	10
Other southern yellow pine	10	3
Total	168	47
Cypress	12	3
Other softwoods	3	1
Total softwoods	183	51
Hardwoods:		
Oak:		
White oak 1/	15	4
Red oak 2/	7	2
Other red oak	33	9
Other white oak	16	5
Total	71	20
Sweetgum	24	7
Tupelo and black gum	23	6
Hickory	15	4
Yellow-poplar	10	3
Other eastern hardwoods	31	9
Total hardwoods	174	49
Total, all species	357	100

1/ *Quercus alba* and *Q. prinus*.

2/ *Quercus borealis*, *Q. falcata* var. *pagodaefolia*, and *Q. shumardii*.

This is especially true in the Douglas-fir region where nearly half of the dead timber on the Tillamook Burn has been salvaged. In all, there are 88 billion cubic feet of sound wood in dead and cull trees and in hardwood limbs: cull trees provide about 60 percent of this material; salvable dead trees, 10 percent; and limbs, about 30 percent (table 18).

The net volume of sound wood in cull trees, 56 billion cubic feet is widely distributed—more than 40 percent in the South, 30 percent in the North, and over 25 percent in the West and Coastal Alaska. In the East, most of the cull tree volume is hardwood, 37 million out of 41 million cubic feet, and more than half of it is in sound cull trees. In the West and Coastal Alaska, softwood accounts for 14 million cubic feet of the total cull tree volume of 15 million cubic feet; nearly all this total volume of sound wood is in rotten cull trees.

The net volume of sound wood in salvable dead trees amounts to 9 billion cubic feet, including 37 billion board feet of salvable dead sawtimber volume. Almost 90 percent of it is in the West; the East has less than 1 billion cubic feet, mostly dead chestnut. In sawtimber terms, the salvable dead softwood in the West measures some 34 billion board feet, of which 23 billion occurs in the Douglas-fir subregion alone.

Hardwood limb volume, 23 billion cubic feet, is concentrated in the East. More than half of it is in the North.

ADDITIONAL VOLUME ON OTHER LAND

In addition to the timber on commercial forest land there is considerable timber on noncommercial forest land and on nonforest land. Since most of this timber has no commercial value or is restricted from cutting, no estimate has been made of its total volume.

The forest lands withdrawn from timber use for parks, monuments, and for natural and wilderness areas carry a substantial volume of sawtimber. Other noncommercial forest lands, such as subalpine forests and swamps often have much small timber and in the aggregate this volume may be considerable, too. The extensive noncommercial areas of pinyon pine-juniper and hardwood types in the West and Plains are estimated to have over 400 million cords of wood suitable for fuel and fence posts:

Region	Pinyon pine-juniper (million cords)	Hardwood (million cords)
Southern Rocky Mountain	284.5	43.5
California	37.4	39.5
Plains (west of 100th meridian)	3.7	6.8
Northern Rocky Mountain	1.4	8.8
Pacific Northwest	.2	.7
Total	327.2	99.3

Table 18.--Net (sound wood) volume of cull trees, salvable dead trees, and hardwood limbs, by section, 1953 (United States and Coastal Alaska)

Class of material	All Sections	North	South	West	Coastal Alaska
	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.
Cull trees:					
Sound cull trees	25.5	7.7	16.2	1.4	0.2
Rotten cull trees	30.8	9.3	8.2	8.3	5.0
Total, cull trees	56.3	17.0	24.4	9.7	5.2
Salvable dead trees:					
Sawtimber trees 1/	7.4	.4	.2	6.7	0.1
Poletimber trees	1.3	.2	.1	1.0	..
Total, salvable dead trees	8.7	.6	.3	7.7	0.1
Hardwood limbs	23.3	13.6	8.1	1.6	(2/)
Total, all classes	88.3	31.2	32.8	19.0	5.3

1/ Including 37 billion board feet of salvable dead sawtimber.
2/ Less than 50 million cubic feet.

As large as these volumes are, though, the timber they represent has such limited use, present and prospectively, that it is not included in national estimates of sawtimber and growing stock.

On nonforest land there is also an additional but unmeasured volume of timber. In this category are the trees in open country along watercourses, fence rows, shelterbelts and windbreaks, and highways. Also included is the volume of trees in suburban areas, city parks and streets, orchards, and the volume on scattered timbered plots less than 1 acre in the East or less than 10 acres in the West. Although widely scattered and generally of little value except for fuel, the volume of wood on such areas is unquestionably great. From the viewpoint of meeting the requirements of the forest industries, timber on both the noncommercial forest land and the nonforest land has limited economic significance and is not considered normally a part of the timber resource available for industrial use.

OWNERSHIP OF TIMBER 4/

Slightly more than half of the total sawtimber volume of the United States and Coastal Alaska is on private forest land. The rest is public timber in Federal, State, county, and municipal forest holdings. Of the total forest growing stock, private forests contain a somewhat larger share--nearly three-fifths (fig. 13 and table 19). Slightly more than half of the privately-owned sawtimber volume and nearly two-thirds of the privately-owned growing stock are in the East. About 90 percent of all the timber in the East--measured either as sawtimber or as growing stock--is on private land. Industrial and other nonfarm owners have somewhat more than half of the private timber and farmowners somewhat less than half. Public timber in the East is mostly in national forests, although there are sizable State forest holdings, especially in the northern States.

The West, in sharp contrast to the East, contains more than four-fifths of the nation's publicly-owned timber, both growing stock and sawtimber. Some 40 percent of the western timber resource occurs on private land; about 60 percent is on public land. Industrial and other nonfarm timber lands have most of the private timber; the volume of farm-owned timber in the West is small. National forests contain most of the public timber in the West while smaller amounts are administered by other Federal agencies and by the States. In Coastal Alaska nearly all of the timber is in public holdings; the national forests alone include 90 percent of the timber.

Nationally, the ownership pattern has marked contrasts with respect to tree species (table 20). Private forest lands have nearly 90 percent of the total volume of hardwood sawtimber, but less than 45 percent of the softwoods. National forests now carry slightly more softwood sawtimber than all private forest land. Of the softwood sawtimber

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4/ A more complete discussion of forest ownership is included in a separate report, "Ownership of Forest Land and Timber."

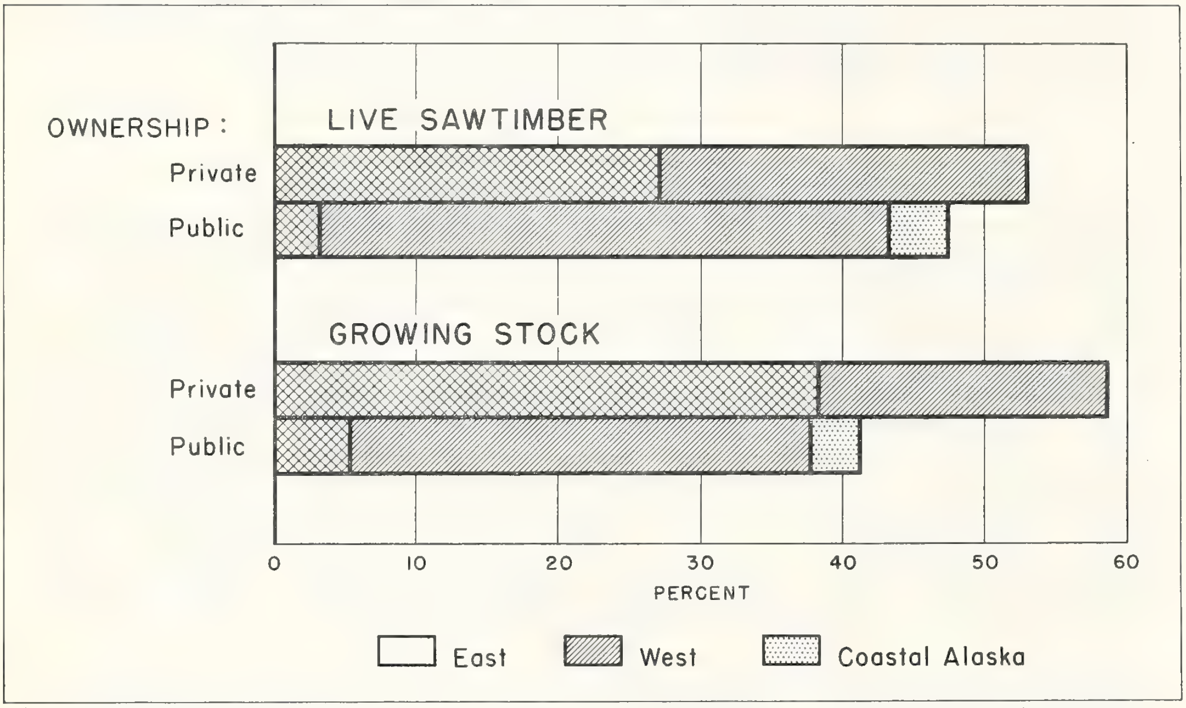


Fig.13 – Distribution of timber volume on commercial forest land by ownership class and section, United States and Coastal Alaska, 1953.

Table 19.--Net volume of live sawtimber and growing stock on commercial forest land, by ownership class, and by section, 1953
(United States and Coastal Alaska)

LIVE SAWTIMBER

Ownership class	United States and Coastal Alaska	Coastal Alaska	United States	North	South	West
	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.
Private:						
Farm	308	..	308	102	144	62
Industrial and other	772	(1/)	772	132	178	462
Total	1,080	(1/)	1,080	234	322	524
Public:						
National forest	766	83	683	13	23	647
Other Federal	135	6	129	4	8	117
State and local	76	..	76	15	4	57
Total	977	89	888	32	35	821
Total, all ownerships	2,057	89	1,968	266	357	1,345

GROWING STOCK

Ownership class	United States and Coastal Alaska	Coastal Alaska	United States	North	South	West
	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.
Private:						
Farm	103	..	103	39	50	14
Industrial and other	201	(1/)	201	55	54	92
Total	304	(1/)	304	94	104	106
Public:						
National forest	163	17	146	6	7	133
Other Federal	28	1	27	2	2	23
State and local	22	..	22	9	1	12
Total	213	18	195	17	10	168
Total, all ownerships	517	18	499	111	114	274

1/ Less than 0.5 billion.

Table 20.--Net volume of live sawtimber on commercial forest land by ownership class, and by softwood and hardwood, 1953 (United States and Coastal Alaska)

Ownership class	All species	Softwood	Hardwood
	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.
Private:			
Farm	308	140	168
Industrial and other	772	579	193
Total	1,080	719	361
Public:			
National forest	766	740	26
Other Federal	135	127	8
State and local	76	62	14
Total	977	929	48
Total, all ownerships	2,057	1,648	409

on private holdings, industrial and other nonfarm owners hold 80 percent. Although farm forests account for only 20 percent of the privately-held softwood, they contain close to half of all the hardwood sawtimber on private lands.

ACCESSIBILITY OF TIMBER

Historically, the lack of ready access to timber has had an adverse effect on the orderly development of the timber supply. Early logging was concentrated along streams where water transport was feasible. Later, as railroads pushed westward, cutting of timber developed along rail lines and more recently along truck logging roads. The result has been heavy cutting of the more accessible areas, leaving the remote and mature timber untouched.

In the East, with the exception of a few areas, accessibility is no longer a major problem. In the West, and principally on public lands in mountainous areas, there is still a problem of accessibility. In such areas road construction will be costly. Recently, the cost of construction for main timber access roads has exceeded $50,000 per mile in parts of Idaho and Montana because of rough topography. In California the cost may exceed $100,000 per mile for some areas. Lateral roads require an additional outlay.

Three-fifths of the old-growth sawtimber in the West is on national forest areas, mostly where further development awaits construction of access roads. Only on one-third of this old-growth acreage is 76 percent or more of the allowable cut being harvested. On nearly half of the western national forest old-growth area, the cut being made is less than 50 percent of the cut allowable under good management (table 21).

But progress is being made in overcoming the accessibility problem. Whereas very few timber access roads were built on western national forests before 1940, and less than 800 miles per year between 1940 and 1951, the annual rate of construction in 1952 was 1650 miles and in 1954 it was 2,600 miles. The job ahead, though, is still big on national forests alone.

In Coastal Alaska some progress is being made too; but, though most of the forest lies within a few miles of tidewater, the remoteness of that region continues to be a major obstacle to timber use.

TIMBER QUALITY

In evaluating timber quality in the past, a common criterion has been stand age. Though little was known about the quality make-up of young-growth timber, it was generally recognized that old-growth stands--composed of the larger, slower-growing trees--have preferred quality characteristics that young-growth stands--composed of the smaller, faster-growing trees--do not have. This distinction is still significant in evaluating the present timber supply. The old-growth area is only 10 percent of the total commercial forest area but the relatively heavy stands of timber on this area constitute the major source of high quality wood today.

Table 21.--Area of old-growth sawtimber on national forest, by proportion of allowable cut being harvested, and by region, 1953 (West and Coastal Alaska)

Region	Total, old-growth area	Area[1] on which percentage of allowable cut being harvested is--			
		0 - 25	26 - 50	51 - 75	76 - 100
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
West:					
Pacific Northwest:					
Douglas-fir subregion	4,017	430	639	906	2,042
Pine subregion	6,115	969	137	1,829	3,180
Total	10,132	1,399	776	2,735	5,222
California	6,500	1,997	1,098	994	2,411
Northern Rocky Mountain	6,011	1,692	2,355	1,499	465
Southern Rocky Mountain	5,567	1,255	966	1,012	2,334
Total	28,210	6,343	5,195	6,240	10,432
Coastal Alaska	3,360	3,360	..	..	..
Total, West and Coastal Alaska	31,570	9,703	5,195	6,240	10,432
	Percent	Percent	Percent	Percent	Percent
Percent	100	31	16	20	33

1/ Based on areas of national forest working circles.

Young growth stands, now occupying 90 percent of the commercial forest land, must be looked to for the future, especially in the East where almost no old growth remains. In recent years, timber and other surveys have been helpful in evaluating timber quality on young growth areas, in indicating the way quality is changing, and in showing trends in quality requirements.

Quality requirements for timber are of special significance for they tend to place limitations on the utility of the total timber supply. These limitations are due to the close relationship between timber quality and at least three aspects of timber utilization: product specifications, product costs, and product technology.

Timber product specifications, except for bulk products like pulpwood, chemical wood, and fuelwood, are higher--much higher in some instances--than standards used in the timber inventory. The low-grade sawlog in the minimum sawtimber tree, for example, is far too poor in quality for the manufacture of veneer or the upper grades of lumber. Increased outlets for wood as cellulose give added significance to estimates of sound wood, but even in such markets the ratio of cull to sound wood places a limit on what timber can be used. Hence, timber volume estimates often must be discounted to some degree before they become realistic estimates of timber supply.

Costs of logging and processing timber are influenced by tree and stand quality. Limby trees, sparse stands, small trees, and numerous defects all spell high unit costs for the end product. And with knotty, crooked, or defective logs and bolts, even the most efficient workers equipped with the best machinery cannot be as productive as those processing high quality timber. While specifications for logs and bolts are often set with regard for the manufacturer's break-even point, few manufacturers can operate for long with no raw materials better than the minimum. To support stable and profitable industries, the timber base must offer a reasonable share of better-than-minimum quality trees and stands. Thus, cost factors tend to limit further the estimates of the timber supply.

Product technology is closely related to quality, too. Where low-grade timber comprises the bulk of the supply as it does in some areas, economic forces press for advancement in technology. And when such advances take place, usually there is a downward revision in the minimum specifications for quality. The cellulose-based industries are a good example of this effect. Thus, gains in technical knowledge offset low quality to some extent.

Recognizing the importance of all these aspects of quality in understanding the utility of the present total supply of timber, what then is the present quality situation? These factors are of particular importance: tree quality as expressed by log grades, and as related to tree size; and stand quality as affected by the occurrence of cull trees and as influenced by species composition.

Log Grades Measure Tree Quality

In various parts of the country, log grades have been developed as common units for expressing the quality of sawlogs and standing timber. These grades take into account diameter, length, and amount and character of defects in individual logs. The objective generally is to express probable lumber grade recovery when the logs are sawed into lumber. In the Southeast, for example, a test of over 1,000 pine logs showed that Grade 1 logs yielded 75 percent of their volume in C and Better lumber; Grade 2, 57 percent; Grade 3 and 4 combined, only 12 percent. Thus, the lower the grade of the log the lower the percentage of high quality lumber.

Log grades have been used to estimate the quality of much of the standing timber in the East. For southern yellow pine, they indicate that the lumber which could be sawed from present stands would be less than one-fifth Grade C and Better, one-fifth would be Number 1 Common, and more than three-fifths would be Number 2 Common or poorer. Much the same situation is shown by the log grade distribution of hardwood sawtimber volume (table 22).

In eastern young growth timber the high percent of volume in Grade 3 logs has come about gradually and through a number of causes. The repeated occurrence of fire, disease, and insects in years past has had much to do with the present quality distribution. Also prevailing economic conditions have favored removal of the higher quality sawtimber and the premature cutting of successively smaller trees. Logging damage to remaining trees has frequently resulted in additional defect. Many of the present young growth hardwood stands originated as stump sprouts and not only are such sprouts subject to heart rot but they also frequently arise in multiple stems of poor form.

That quality is a continuing problem is indicated not only by the present status but also by successive inventories. In the Lake States, timber inventories by log grades in 1936 and 1953 show distinct trends in the percentage of sawtimber volume represented by Grade 1 logs:

	1936 (percent)	1953 (percent)
Sugar maple	26	18
Yellow birch	36	15
Basswood	29	21
Elm	27	17
Beech	19	5
Oak	16	12
Aspen	5	9
Soft maple	13	4

In the regional estimates for the West, log grades have been used less widely than in other sections. In some places, during the past several years, there has been a gradual decrease in the quality of logs coming into primary manufacturing plants. The decrease is due, chiefly, to two things: logging started in the most accessible and

Table 22.--Percentage distribution of live hardwood sawtimber volume, by log grades, and by region, 1953[1] (East)

Region	Grade 1--Standard lumber logs	Grade 2--Standard lumber logs	Grade 3--Standard lumber logs and tie and timber logs	Total, all grades	Volume in areas sampled
	Percent	Percent	Percent	Percent	Billion bd. ft.
New England	18	27	55	100	24.4
Middle Atlantic	20	21	59	100	61.0
Lake States	13	27	60	100	35.4
Central	7	11	82	100	53.6
South Atlantic	24	33	43	100	5.1
Southeast	10	20	70	100	62.5
West Gulf	10	19	71	100	45.1
Weighted average	13	20	67	100	287.1

1/ The percentage distribution is based on sampling of 75 percent of the hardwood sawtimber volume in the East. In all but the South Atlantic Region, the sampling was well distributed throughout the regions. The South Atlantic sample covers only the southern Coastal Plain counties in North Carolina. The Plains Region was not sampled.

highest quality timber and has gradually moved into areas of lesser value, and as stumpage became scarcer and higher priced, more timber of poorer quality was harvested. This situation is obvious in the Douglas-fir subregion where the best timber occurred at lower elevations around Puget Sound and in the Lower Columbia Valley. As this timber was cut, logging moved to higher elevations and to areas in southwest Oregon where per-acre volumes are less and where the percentage of high-grade logs is lower.

Small Trees Lack Quality

In young growth timber small trees inevitably make up a high proportion of the sawtimber volume and the result is a high percentage of logs of low grade (table 23). To illustrate, the recent inventory of timber in Alabama showed 88 percent of the southern yellow pine sawtimber volume in trees 18 inches or smaller in diameter, and only 12 percent in 20-inch and larger trees. In the smaller trees less than 1 percent of the volume is in Grade 1 logs and only 11 percent is in Grade 2. On the other hand the larger trees have 40 percent of their volume in Grades 1 and 2, and 60 percent in Grades 3 and 4. Most of the sawtimber volume in the small trees, 89 percent, is in Grade 3 and 4 logs—not an encouraging situation for industries needing high quality softwoods.

More than 40 percent of eastern hardwood sawtimber volume occurs in trees of the 12-and 14-inch diameter classes. Such trees are too small to contain any Grade 1 standard logs and even medium-sized hardwood trees of the 16-and 18-inch diameter classes seldom carry more than 5 percent of their volume as Grade 1 sawlogs. Only the larger trees yield significant amounts of high quality sawlogs. But the volume of hardwood trees in the 20-inch and larger diameter classes represents less than 30 percent of the total hardwood sawtimber volume. Even so, the volume in larger trees is relatively greater in hardwoods than in softwoods. Omitting the volume in 10-inch softwoods, this is demonstrated by the following comparison of eastern hardwood volumes in the 12-inch and larger diameter classes:

	Softwoods (percent)	Hardwoods (percent)
12-and 14-inch trees	56	42
16-and 18-inch trees	28	30
20-inch and larger trees	16	28
Total	100	100

Tree size, though, is not yet a major factor in the West and in Coastal Alaska. Softwood trees in the 32-inch and larger diameter classes contain about half of western sawtimber volume (table 24). Redwood, Douglas-fir, sugar pine, and western white pine sawtimber trees, on the average, are bigger than sawtimber trees of other western species. Compared to Coastal Alaska, large sawtimber trees are relatively more plentiful in the West; only one-third of the Alaskan sawtimber volume is found in the 32-inch and larger diameter classes.

Table 23.--Distribution of live sawtimber volume, by species group, and by tree-diameter class (East), 1953

Species	Total	Diameter class (inches)1/			
		10	12 and 14	16 and 18	20 and larger
	Percent	Percent	Percent	Percent	Percent
Softwoods:					
Southern yellow pine	100	24	44	22	10
Other softwoods	100	22	38	21	19
Total, or average	100	24	43	21	12
Hardwoods:					
Oak	100	..	41	29	30
Gum and yellow-poplar	100	..	44	33	23
Yellow birch and sugar maple	100	..	37	30	33
Other hardwoods	100	..	44	29	27
Total, or average	100	..	42	30	28
Total all species	100	9	42	27	22

1/ The estimates of sawtimber volume include the volume in softwood trees of the 10-inch diameter class but do not include hardwood trees of that class.

Table 24.--Distribution of live softwood sawtimber volumes by species group, and by tree-diameter class, (West and Coastal Alaska) 1953

Species	Diameter class (inches)			Total
	12 to 20	22 to 30	32 and larger	
	Percent	Percent	Percent	Percent
Douglas-fir	18	23	59	100
Ponderosa pine and Jeffrey pine	20	36	44	100
Sugar pine and western white pine	21	20	59	100
Other western softwood	28	29	43	100
All softwood	23	27	50	100

Timber inventory data point to a continuing decrease in the diameter of the average sawtimber tree. In the East, for example, between 1935 and 1948 the forest survey in Mississippi showed that softwood trees of the 20-inch and larger diameter classes decreased 42 percent in number; 12-inch softwood trees numbered only 5 percent less. Among the Mississippi hardwood species, decreases were substantial in the 16-inch and larger diameter classes. Between the 1936 and 1953 surveys in the Lake States, the proportion of sawtimber volume in trees of the 16-inch and smaller diameter classes increased as follows: sugar maple from 44 percent to 61 percent, yellow birch from 36 percent to 55 percent, and white and red pine from 46 percent to 68 percent. And in the South Atlantic Region, between the initial survey in the 1930's and the 1953 survey, the percentage of softwood trees sawtimber in 20-inch and larger diameter classes declined from 17 percent to 14 percent, while the hardwoods changed from 47 percent to 34 percent.

In the West, where old-growth provides most of the timber harvest, gradual decreases in average diameter are to be expected. For example, trees of the 42-inch and larger diameter classes accounted for 55 percent of Douglas-fir sawtimber volume in western Washington in 1933; by 1953 these larger trees represented only 45 percent of the total. Thus, even in the young-growth forests of the East as well as in the old-growth forests of the West the size of the average trees is declining and the problems relating to quality increase accordingly.

Cull Trees Numerous

Eastern hardwood stands are characterized by a large over-burden of cull trees, many of them holdovers from previous cuttings. The sound wood in these trees is equivalent to one-fourth of the entire hardwood growing stock. In the South alone, the net volume of hardwood cull trees exceeds one-third of the hardwood growing stock. And, of all sound hardwood volume in the East, some 18 percent[5/] is in cull trees:

Region	Hardwood cull-tree volume as proportion of-- Growing stock (percent)	All-timber volume (percent)
North:		
New England	22	17
Middle Atlantic	14	11
Lake States	16	13
Central	20	13
Plains	22	14
Average	18	13
South:		
South Atlantic	29	20
Southeast	42	27
West Gulf	31	21
Average	34	23
Total East, average	25	18

5/ These percentages are not equivalent to "cull percent", since the latter includes the sizable volume of sound but defective material in growing stock trees.

Cull trees take up growing space and thus reduce the productivity of the forest land. Because rotten cull trees contain proportionately less sound wood than growing stock trees, their net volumes underestimate the growing space that cull trees occupy. For example, in the Southeast and West Gulf regions, cull trees account for more than one-fifth of the total basal area of all trees in the 6-inch and larger diameter classes. About every fifth tree of sawtimber size in the Central Region is a cull tree. And in New England, where hardwood cull trees make up 17 percent of live-tree net volume, they represent more than 22 percent of the gross volume.

The inventory of cull hardwood in the East has been gradually changing. In some regions, stand quality has been raised by the expanding use of low-quality hardwood trees for pulp-making. On the other hand, in the Southeast where successive estimates are available, stand deterioration seems to be continuing. Here, the original surveys found 77 percent of the total sound hardwood volume in growing stock trees and 23 percent in cull trees. By 1953 the sound wood proportion in growing stock trees had dropped to 71 percent and the cull tree percentage had climbed to 29. Heavy cutting of the better trees had reduced the level of growing stock. Left to grow, the cull trees increased in volume.

Compared to hardwood, cull trees of softwood species occupy a small proportion of softwood stands. In the West, 3 percent of the total sound volume of softwood is in cull trees; in the East, cull trees account for 5 percent of the sound softwood volume. Only in Coastal Alaska are the softwood forests characterized by a large volume in cull trees—some 22 percent of the total sound volume in that region. However, in all regions the sound wood volume of softwood growing stock includes much material that is too defective for sawlog use.

Better Quality Species Diminishing

Composition of timber volume by species and distribution of area by forest types are not exact criteria of stand quality, but some species and types are generally considered more desirable than others. The available evidence shows that the more aggressive but less desirable species are tending to displace preferred species in both the East and the West.

In the East, many of the young-growth forest types are not especially stable. As a result of disturbance due to cutting, fire, grazing, or insect and disease infestations, some component species are favored and the type tends to change. Even without disturbance of any kind, most second-growth types tend to change with time as short-lived species die out and as conditions for regeneration are altered. For example, in the South the leading softwood type, loblolly-shortleaf pine, has been expanding at the expense of the longleaf-slash pine. On the other hand, the more aggressive hardwood types in some areas, as a result of continued fire protection, are replacing loblolly-shortleaf pine.

Because of fire, cutting, hardwood competition and lack of seed sources, white pine, once the prominent forest type in the Lake States, has been reduced to about a million acres. The aspen-birch type has come in

instead. In the second-growth spruce-fir stands of the Northeast, hardwoods tend to supplant softwood. The net effect of these shifts has been a gradual reduction in the Eastern softwood acreage and an increase in hardwood acreage. The effect of these type shifts will be even more noticeable in the future as young growth matures.

The relationships between species composition and timber quality are also apparent in the East. For example, the following tabulation shows that between 1936 and 1947 the proportion of better quality species in the sawtimber volume inventory of South Carolina decreased while the proportion of poorer quality species increased:

	1936 (percent)	1947 (percent)
Southern yellow pines	57	54
White oaks	3	2
Sweetgum	10	7
Red oaks	4	6
Tupelo and blackgum	8	10
Other species	18	21
Total all species	100	100

These comparisons are typical wherever resurveys of large forest areas have been made. They bear out the general observation that cuttings which are concentrated on preferred species or high-quality trees often result in lowering of stand quality because the less desirable species that remain, or sprout, or seed in tend to occupy more area.

Type and species changes are also taking place in the West. Lodgepole pine has formed dense stands following fire in some other softwood types. Through cutting of white pine and not the associated species, other softwoods now predominate on many former white pine areas in the Northern Rocky Mountain Region. Also, because of blister rust, some white pine stands have been giving way to fir and larch. In local areas in the Pacific Northwest, as the Douglas-fir type passes maturity, western hemlock invades and appears in great abundance. Ponderosa pine, a preferred species, has lost ground to less valuable species such as white fir which in the West is exceptionally aggressive following logging.

These are only a few of the numerous examples of changes in forest types and species composition that could be cited to show declines in stand quality and losses of potential productivity of the forest site. Changes that indicate improvement in stand quality are less numerous--probably because most such changes take place very slowly. Although it is difficult to appraise the magnitude of such changes, it is apparent in both the East and the West that the more aggressive but less desirable species are tending to displace preferred species.

TRENDS IN TIMBER VOLUME

From time to time since 1895, estimates have been made of the volume of standing timber in the United States. Occasionally, a series of estimates, such as the following, have been presented as evidence of past trends in the nation's timber supply:

Year 1/	Volume Estimate (billion bd. ft.)	Year 1/	Volume Estimate (billion bd. ft.)
1895	2,300	1930	1,668
1902	2,000	1938	1,764
1905	1,970	1945	1,621
1908	2,500	1945	1,601
1909	2,826	1953	1,968
1920	2,215		

1/ Sources of published estimates of timber volume in the continental United States are as follows:

1895 - Fernow, B. E. Facts and Figures Regarding Our Forest Resources Briefly Stated. U. S. Dept. Agr., Div. Forestry, Cir. 11, 8pp. 1896.

1902 - ____________. Economics of Forestry. 520 pp. 1902. New York.

1905 - Defebaugh, J. E. History of the Lumber Industry of America. 2 v. 1906-07. Chicago.

1908 - Kellogg, R. S. The Timber Supply of the United States. U. S. Dept. Agr. Forest Serv. Cir. 166, 24 pp., illus. 1909.

1909 - U. S. Dept. Commerce and Labor, Bur. Corps. Summary of Report of the Commissioner of Corporations on the Lumber Industry. Pt. I. Standing Timber. 38 pp., illus. 1911.

1920 - U. S. Dept. Agr. Forest Serv. Timber Depletion, Lumber Prices, Lumber Exports, and Concentration of Timber Ownership. Rpt. Sen. Res. 311. 66th Cong., 2d Sess. 71 pp., illus. 1920.

1930 - ______________________. A National Plan for American Forestry. Sen. Doc. 12. 73rd Cong., 1st Sess. 2 v. 1677 pp., illus. 1933.

1938 - Cong. U. S., Joint Committee on Forestry. Forest Lands of the United States. Sen. Doc. 32. 77th Cong., 1st Sess. 44 pp, illus. 1941.

1945 - Woods, J. B. Report of the Forest Resource Appraisal. Amer. Forests 52: 413-28. 1946.

1945 - U. S. Dept. Agr. Forest Serv. Forests and National Prosperity Misc. Pub. 668, 99 pp., illus. 1948. (Reappraisal Rpt.).

While trends may seem apparent, all of the published estimates of sawtimber volume actually lack direct comparability. However, since 1928, when a national forest survey was authorized by Congress, the measurement of timber volume by board foot and cubic foot units has been extended to many forest regions. Each subsequent national estimate has been based more and more upon this forest survey. Thus, while the

timber volumes shown in the more recent reports are not comparable as given, they can be adjusted to the extent that actual survey data are available.

The reasons for lack of comparability are many and complex. Briefly, though, they may be summarized as follows: As efforts have progressed to measure accurately the timber supply, utilization standards have changed, so that the sawtimber and growing stock volumes based on these standards have changed too. For sawtimber trees, the earlier studies used higher diameter limits than the more recent studies. Likewise, the percent of defect permitted in merchantable timber is higher now than formerly and some species once considered as noncommercial are now included in the commercial group. These and other changes in utilization standards have a most significant bearing on the comparability of periodic timber volume estimates.

Another factor has been the changing definition as to what constitutes forest land. Consequently, at times estimates of the commercial forest area have increased and at other times they have decreased, thus changing the estimate of the supply of merchantable timber. Changes in land use as the result of land clearing or abandonment are involved too in determining timber volume.

Improvement in timber inventory procedures has also been a factor. Use of more accurate base maps, of aerial photographs, and of scientific sampling methods revealed inadequacies of older estimates and the danger of comparing them.

Finally, the progress of the national forest survey since 1930 has been a major factor in refining the successive estimates. As each periodic appraisal was made in 1938, 1945, and 1953, the forest area covered by the national survey project has increased. By 1953, 86 percent of all the commercial forest area had been covered by an initial survey including more than 30 percent which had been reinventoried. In 1945 only 60 percent had been covered and in 1938 less than 55 percent, whereas in 1932 the timber survey project was just starting. Thus, unless the more recent area data and utilization standards are applied to the earlier basic material, the published reports inevitably lack comparability.

Growing Stock Shows Small Increase Since 1945

Taking into account, to the extent possible, the factors noted above, the data in published reports have been adjusted as shown in table 25. These adjustments, although crude in some instances, provide for major area changes, lowering of the diameter limit for sawtimber, interpolation between original survey and resurvey data where possible, projecting backward 1953 data using growth rates and estimated annual drain, and using other data that subsequently became available. Such adjustments were made for total volumes only and not for detailed estimates by regions except where by so doing the derivation of more accurate totals was facilitated.

Table 25.--Estimates of growing stock and sawtimber volume, 1930-45 (Continental United States)

Year	As published 1/		As adjusted for comparability 2/	
	Growing stock	Sawtimber	Growing stock	Sawtimber
	Billion cu. ft.	Billion bd. ft.	Billion cu. ft.	Billion bd. ft.
1930	487	1,668	527	2,171
1938	519	1,764	508	2,096
1945	470	1,601	490	2,006
1953	498	1,968	498	1,968

1/ Sources of published data are as follows:

1930 - U. S. Dept. Agr. Forest Serv. A National Plan for American Forestry. Sen. Doc. 12, 73rd Cong. 1st Sess., 2 v., 1677 pp., illus. Wash., D.C. 1933.
1938 - Cong. U. S., Joint Committee on Forestry. Forest Lands of the U. S. Sen. Doc. 32, 77th Cong. 1st Sess., 44 pp., illus. Wash., D. C. 1941.
1945 - U. S. Dept. Agr. Forest Serv. Gauging the Timber Resources of the U. S. 62 pp., illus. Wash., D. C. 1946.

2/ See text for explanation of adjustments.

From the adjusted data certain general trends are indicated. For the first time since 1930 the growing stock shows a slight upward trend of about one billion additional cubic feet per year for the past 8 years. The decline in the previous period, 1938 to 1945, had been nearly 3 billion cubic feet per year. In sawtimber, however, the decline which has been noted in nearly every successive national summary continues.. In 8 years, 1945 to 1953, the total sawtimber supply dropped 38 billion board feet or over 4 billion board feet per year.

Since the 1945 and 1953 data are in greater detail, it is possible to analyse trends in this period by hardwoods and softwoods and by the eastern and western units. Table 26 brings out a number of trends. Perhaps most significant is the sharp increase in eastern hardwoods--a 17 percent gain in growing stock and a 9 percent gain in sawtimber. To the extent this increase has resulted in displacement of the already scarce eastern softwoods, additional hardwood volume may be an undesirable trend.

Another point to note is the continued decline in western softwoods. Both growing stock and sawtimber are down 5 percent. This reflects a logical trend that can be expected to continue until the old-growth timber is removed. With more emphasis on accessibility and use of old-growth stands, the second-growth timber will have an opportunity to gain in size and volume and provide a more plentiful supply for the future. Eastern softwoods appear to have leveled off in growing stock but show a small decline in sawtimber. Although the decline is limited, emphasis needs to be on increasing growing stock for in most eastern areas softwoods are in short supply.

Table 26.--Trends in timber volume, 1945-53
(Continental United States)

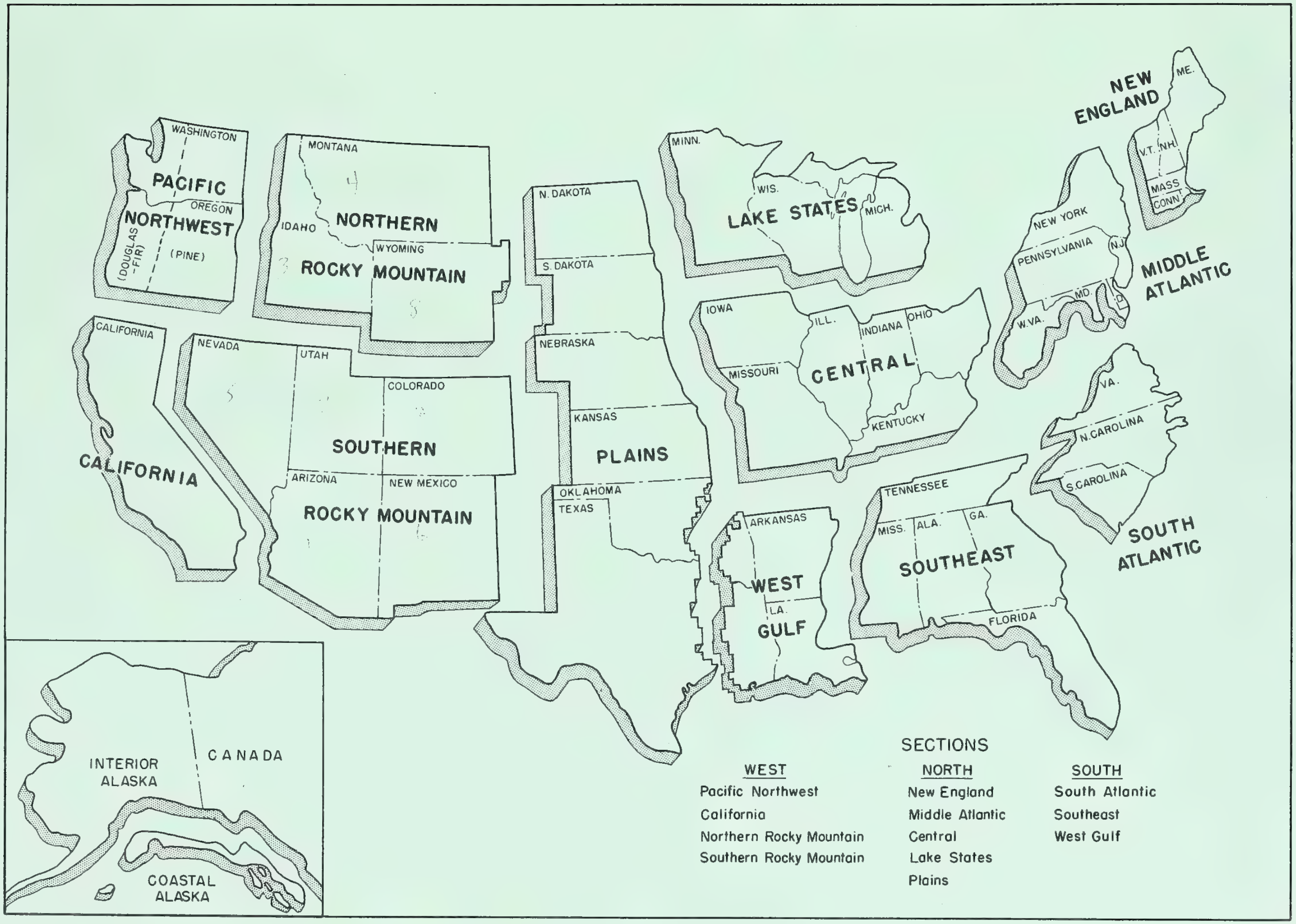
GROWING STOCK

Species group	1945 1/	1953	Change, 1945-53
	Billion cu. ft.	Billion cu. ft.	Percent
Eastern hardwoods	129	151	17
Eastern softwoods	74	74	..
Western species	287	273	-5
Total	490	498	2

SAWTIMBER VOLUME

Species group	1945 1/	1953	Change, 1945-53
	Billion bd. ft.	Billion bd. ft.	Percent
Eastern hardwoods	351	381	9
Eastern softwoods	247	242	-2
Western species	1,408	1,345	-5
Total	2,006	1,968	-2

1/ For comparison with 1953, the data for 1945 have been adjusted for differences in utilization standards, diameter class groupings, and in forest area classifications.



Regions and Sections used in the Timber Resource Review

TIMBER RESOURCE REVIEW

CHAPTER III

GROWTH AND UTILIZATION OF DOMESTIC TIMBER

(Preliminary Review Draft Subject To Revision)

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INDEX TO TIMBER RESOURCE REVIEW REPORTS AND APPENDIX MATERIAL

(Each Chapter and each Section, in the case of Chapters IV and IX, is a separate document)

CHAPTER III. G R O W T H A N D U T I L I Z A T I O N O F D O M E S T I C T I M B E R

(Preliminary review draft subject to revision)

By:

George F. Burks
C. Edward Behre

September, 1955

Contents

G R O W T H A N D U T I L I Z A T I O N

O F D O M E S T I C T I M B E R [1]

Essential to an appraisal of the timber situation is information on annual timber growth, mortality, the amount cut and used, and the volume cut but left unused in woods and mills. In the long run, our timber needs can only be met by growing as much timber of desired species, size, and quality as we need with margin for safety. A comparison of annual timber growth and cut gives one measure of the adequacy of current timber growth. Analysis of cut in recent years provides a starting point for estimating the size of needed future timber crops. Knowledge of present losses from fire, insects, disease, and other causes gives some indication of the extent to which better protection and management may augment the available timber supply in future years. And study of unused woods and plant residues challenges technological progress to make the timber we cut go further.

This chapter presents the available information on current annual growth. It summarizes information on mortality, the nature, causes, effects, and control of which are discussed in Chapter IV in the section on "Forest Protection Against Destructive Agencies." It analyzes timber products output in 1952, and translates this output into the amount of growing stock cut or killed in logging. It then compares timber cut and growth in 1952. Logging and plant residues are analyzed to show their quantity, character, and source, and to ascertain the extent to which they are being utilized. Finally, trends in timber utilization are appraised to throw light on possibilities for better and more complete use of growing stock, greater use of cull and dead trees, reduction of plant residues, and better and more complete use of them.

ANNUAL TIMBER GROWTH AND MORTALITY

ANNUAL TIMBER GROWTH

The United States is emerging from an era in which its needs for timber products could be amply met by cutting of the bounteous supply of virgin timber which was so readily available to our pioneer economy. The Nation has now awakened to the fact that timber for future needs must be grown from year to year as a crop from the soil. Since timber crops require years to mature, we must be taking steps now to assure ample timber crops for generations to come.

As with any other crop, the amount that can be harvested year after year is limited by the amount that is grown each year. But with timber crops, the harvest in any year does not consist of the timber grown that year. It consists of the accumulated growth of many years in the trees that are cut. So, if we are to have a dependable harvest, we must develop

1/ The text and included tables deal chiefly with regional, sectional, and national data. More detailed statistics, including data for individual States, are presented in the Appendix.

and sustain a stock of standing timber in a succession of age classes which will permit the cut to be taken each year in trees of the sizes needed and which, in the aggregate, will have sufficient net annual growth to offset the needed cut.

In the following discussion, annual growth means the net change in volume of timber for a specified year from causes other than cutting. It includes growth of the timber on hand at the beginning of the year (with appropriate allowance for growth not realized because of timber cutting and mortality during the year), plus the total volume of young timber added to growing stock during the year ("ingrowth" of sawtimber or total growing stock, as the case may be), minus the mortality occurring during the year.

As used in this report, annual growth differs from growth as defined in the 1945 Reappraisal project in that it is net growth2/ exclusive of losses from fire, disease, insects, and other causes. On the Reappraisal project, all losses from fire, epidemic losses from insects and disease, and abnormal losses from other causes were not deducted from growth, but were included as part of the drain.3/

The South Leads in Annual Timber Growth

Annual growth of sawtimber in 1952 totaled 47.4 billion board feet for the United States and Coastal Alaska. With growth of poletimber added, the total growing-stock growth was 14.2 billion cubic feet (table 1).

About half of the growth of both sawtimber and growing stock occurs in the South, which has only 40 percent of the commercial forest land. The West has 24 percent of the sawtimber growth and almost the same proportion of the commercial forest land. Its share of growing-stock growth, however, is only 19 percent. The North, with 36 percent of the commercial forest land, has only 25 percent of the sawtimber growth and 33 percent of the growing-stock growth. Growth in the West still tends to be held down by the large residuum of virgin timber which has little net growth. In the East, annual growth reflects the adverse results of past treatment. In their present rundown condition, eastern forests are producing much less than they are capable of.

2/ For those interested in determining gross growth, it can be derived by combining net growth and mortality estimates presented in the following tables or from tables presented in the Appendix.

3/ In addition to losses from fire, epidemics of insects or disease, and other destructive agents, forest drain as reported in the 1945 Reappraisal included commodity drain or the amount of forest growing stock cut for various products, including the volume knocked down or otherwise killed in logging and left unused in the woods. Thus, commodity drain in the Reappraisal report is equivalent to timber cut in this report. No term comparable to forest drain or total drain, as used in the Reappraisal report, appears in this report.

Table 1.--Net annual timber growth by section and region, 1952[1]
(United States and Coastal Alaska)

Section and region	Growing stock			Live sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
North:						
New England	878	291	587	1,857	914	943
Middle Atlantic	1,357	156	1,201	3,160	470	2,690
Lake States	1,180	319	861	2,693	802	1,891
Central	1,128	46	1,082	3,963	249	3,714
Plains	116	9	107	401	40	361
Total	4,659	821	3,838	12,074	2,475	9,599
South:						
South Atlantic	1,908	969	939	6,880	3,670	3,210
Southeast	3,056	1,714	1,342	10,035	6,679	3,356
West Gulf	1,843	881	962	7,102	4,146	2,956
Total	6,807	3,564	3,243	24,017	14,495	9,522
West:						
Pacific Northwest:						
Douglas-fir subregion	998	943	55	5,149	5,010	139
Pine subregion	329	329	..	828	824	4
Total	1,327	1,272	55	5,977	5,834	143
California	595	539	56	2,939	2,895	44
Northern Rocky Mtn.	603	591	12	1,534	1,508	26
Southern Rocky Mtn.	220	194	26	728	677	51
Total	2,745	2,596	149	11,178	10,914	264
Total, United States	14,211	6,981	7,230	47,269	27,884	19,385
Coastal Alaska	32	32	(2/)	128	127	1
United States and Coastal Alaska	14,243	7,013	7,230	47,397	28,011	19,386

1/ Statistics by States are shown in Appendix table 12.
2/ Less than 0.5 million.

Softwoods, generally more desirable than hardwoods, account for 59 percent of the sawtimber growth, but only 49 percent of the growing-stock growth. The larger proportion in sawtimber growth is related primarily to the fact that the minimum size of sawtimber trees in the East is lower for softwoods than for hardwoods. It is worth noting that hardwoods comprise more than half of the sawtimber growth in the East (fig. 1). In the North, they account for four-fifths; in the South, two-fifths. For the reason already stated, these proportions are even larger for growing stock.

The dominant position of the South is due to its lead in softwood growth; it falls a little below the North in hardwood growth. The proportions for softwood sawtimber are: South 52 percent, West 39 percent, North 9 percent. For hardwood sawtimber the distribution is: North 50 percent, South 49 percent, West 1 percent. The distribution of growing-stock growth is generally similar, but for both softwoods and hardwoods the North has a somewhat larger percentage than it has in sawtimber.

Sawtimber growth rates (growth as a percentage of timber volume) are also highest in the South.

	All species	Softwood	Hardwood
	- - - - Percent of sawtimber volume - - - -		
North	4.5	4.2	4.6
South	6.7	9.0	5.5
West and Coastal Alaska	0.8	0.8	1.1

It is well known that the most important softwoods are rapidly growing species. However, the present extremely high growth rate for sawtimber softwoods in the South is partly due to the depleted condition of southern softwood forests and the resulting high proportion of trees just attaining sawtimber size. The generally more favorable growing conditions in the South probably account for the higher growth rates for hardwoods in that section in comparison with the North.

The western softwood growth rate is low because of the old-growth timber which provides a large base but contributes little to net annual growth. Some important western species, however, are inherently fast growing in early life. Among these are western hemlock, redwood, and Douglas-fir.

Southern Yellow Pine Dominates Annual Growth

The southern yellow pines, as a group, account for 30 percent of the entire country's sawtimber growth (fig. 2). The growth of the southern yellow pines is slightly greater than that of all other softwoods combined.

Eastern softwood growth is 84 percent southern yellow pine (table 2). This preponderance reflects the favorable conditions for establishment

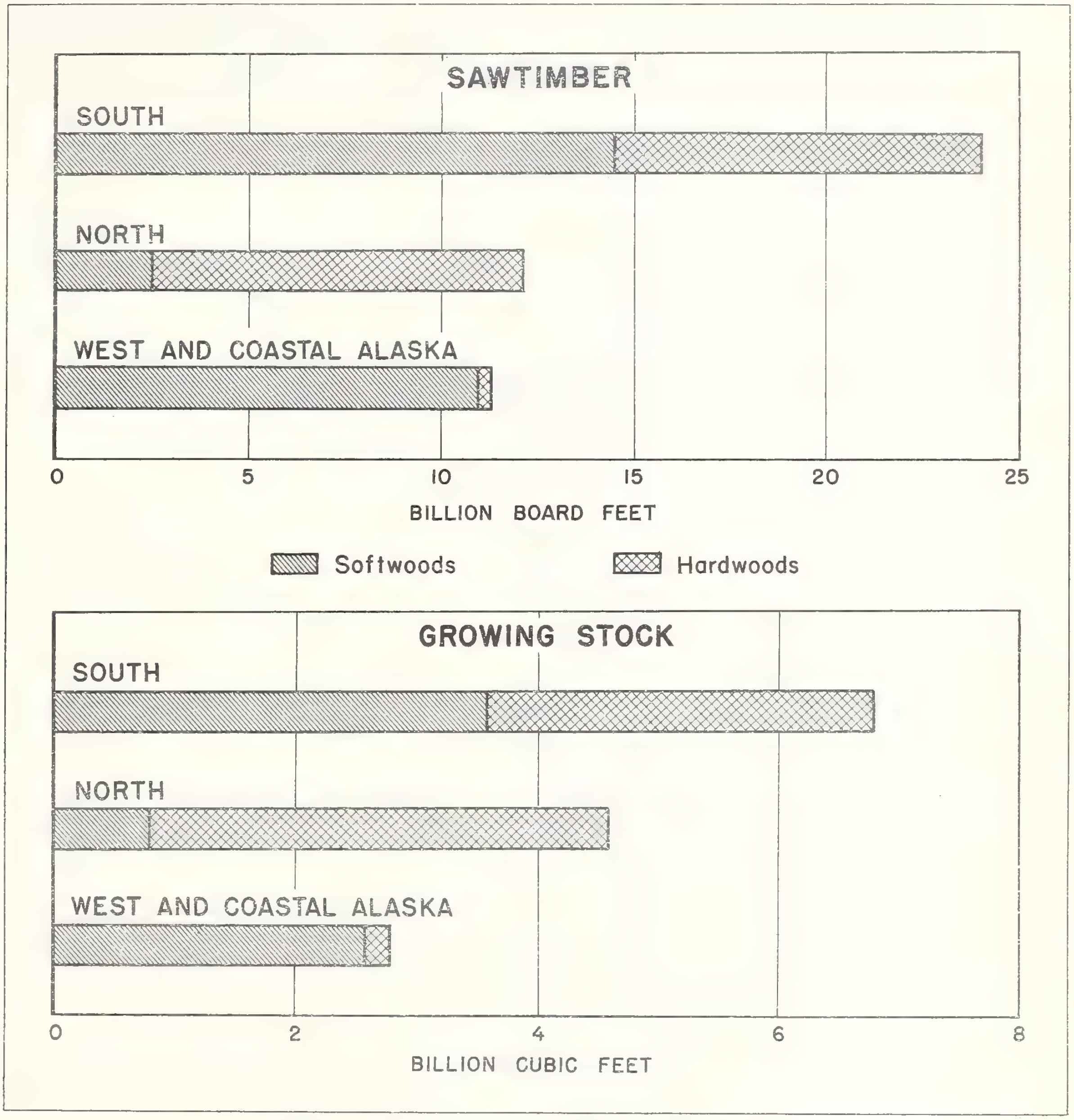


Fig. 1 – Net annual timber growth, 1952

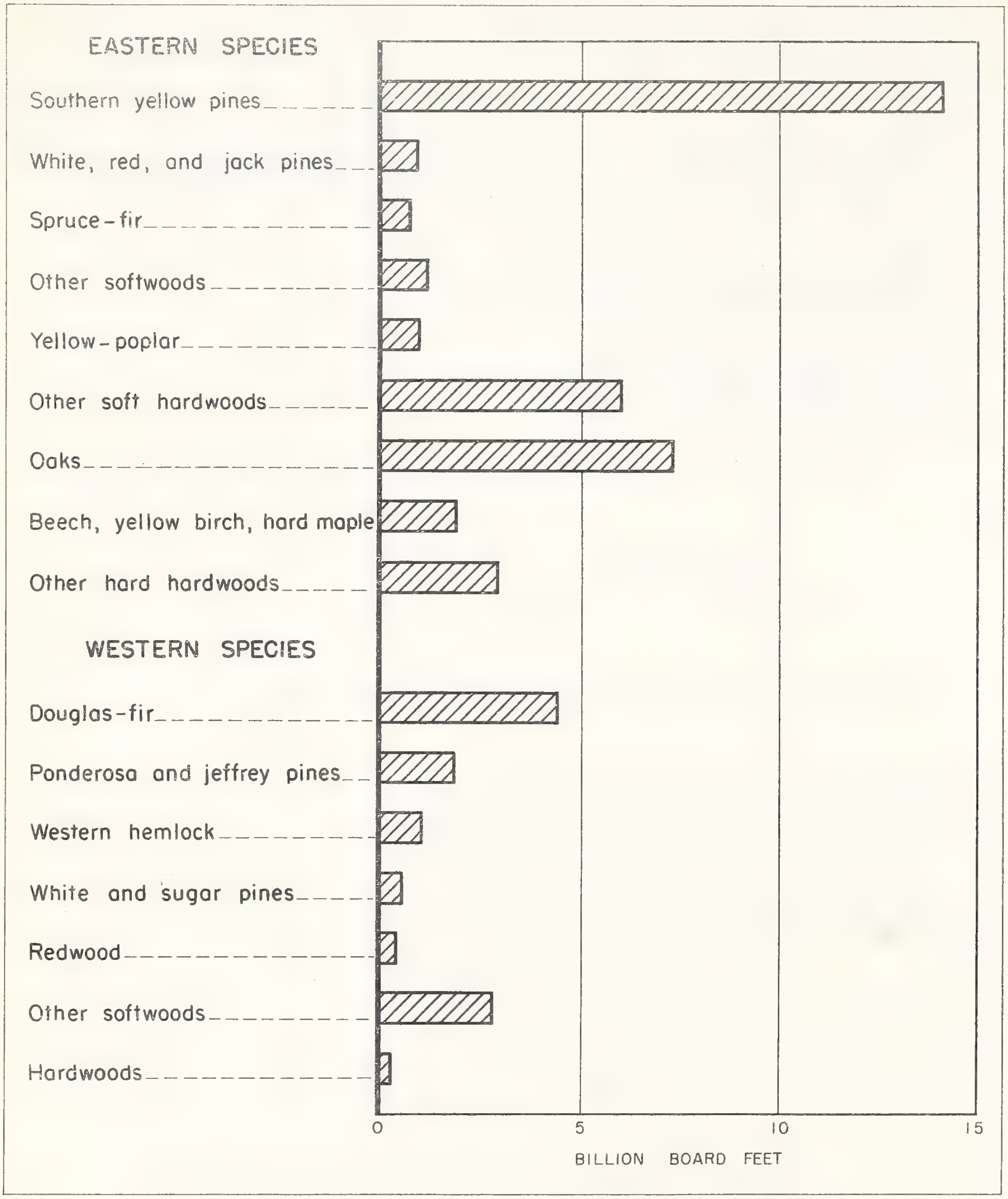


Fig. 2 — Distribution of net annual growth of sawtimber by species group, 1952

Table 2.--Net annual growth of eastern species, by species group, 1952[1]
(Continental United States)

Species group[2]	Growing stock	Live sawtimber
	Million cu. ft.	Million bd. ft.
Softwood:		
White, red, and jack pine	270	906
Southern yellow pine	3,483	14,155
Spruce-fir	291	742
Other softwoods	341	1,167
All softwoods	4,385	16,970
Hardwood:		
Yellow-poplar	289	948
Other soft hardwoods	2,290	6,041
Total	2,579	6,989
Oak	2,478	7,316
Beech-yellow birch-hard maple	718	1,877
Other hard hardwoods	1,306	2,939
Total	4,502	12,132
All hardwoods	7,081	19,121
All species	11,466	36,091

1/ Net annual growth by species groups and regions is shown in tables 13 and 14, pages 42 and 44, of this report and in the Summary of Basic Statistics, tables 33 and 35 in the Appendix.

2/ Reference to the more important species in other softwoods, other soft hardwoods, and other hard hardwoods is found on page 31 of the text.

of pine which prevailed as forest fires were held in check by the spread of organized protection over the huge area of forest land in the South. In contrast, establishment and growth of softwoods on the smaller acreage of suitable land in the North has been impeded by the presence and dominance of hardwoods. White pine, the most important softwood in the North, dominated the timber economy of an earlier period. Yet white, red, and jack pines, as a group, have only 5 percent of eastern softwood growth at present. Similarly, spruce and balsam fir, for years the backbone of the woodpulp industry, have only 4 percent of eastern softwood growth. All other softwoods, chiefly hemlock and cypress, make up the remaining 7 percent.

Much Eastern Hardwood Growth Is of Undesirable Species

Three-eighths of eastern hardwood growth is oak, but a substantial proportion of this is of the less desirable oak species. We can get some measure of this from data on timber volume by species because, generally speaking, growth is proportional to volume. White and red oaks, the most valuable species, comprise only 45 percent of all oak sawtimber volume; the less desirable oaks comprise 55 percent.

Beech, yellow birch, and hard maple, generally valuable for manufacture, account for only 10 percent of eastern hardwood growth. In this group, however, beech--which comprises almost one-third of the group's sawtimber volume--is distinctly less valuable than the other species.

Yellow poplar, one of the most valuable hardwoods, has only 5 percent of the hardwood growth. To be sure, it is a rapidly growing species, but it comprises only 4 percent of the hardwood timber volume.

Thus the five most desirable hardwoods--white oak, red oak, yellow birch, hard maple, and tulip poplar--account for less than 30 percent of all eastern hardwood growth. If other soft hardwoods, increasingly used for pulpwood, are added, the total is still less than 60 percent. This leaves more than 40 percent for the undesirable species.

Douglas-Fir Dominates Annual Growth in the West

Douglas-fir, the country's most widely used species, contributes 39 percent of all the sawtimber growth of the West and Coastal Alaska (table 3 and fig. 2). Two-thirds of this is in the Douglas-fir subregion where the bulk of the Douglas-fir timber is concentrated.

Ponderosa and Jeffrey pines, the former important in every western region, account for 16 percent of western sawtimber growth.

Western hemlock, very largely in the Douglas-fir subregion and Coastal Alaska, is next in line with 9 percent.

The high-priced specialty woods do not loom large in western annual growth: White and sugar pines have only 5 percent, and redwood (all in California) 4 percent.

Table 3.--Net annual growth of western species, by species group, 1952[1]
(Western United States and Coastal Alaska)

Species group[2]	Growing stock	Live sawtimber
	Million cu. ft.	Million bd. ft.
Softwood:		
Douglas-fir	902	4,431
Ponderosa and Jeffrey pine	[3] 479	[4] 1,841
Western hemlock	237	1,038
White and sugar pine	100	535
Redwood	77	396
Other softwoods	833	2,800
All softwoods	2,628	11,041
Hardwoods	149	265
All species	2,777	11,306

1/ Net annual growth by species groups and regions is shown in table 15, page 45 of this report and in the Summary of Basic Statistics, table 34 and 36 in the Appendix.

2/ Reference to the more important species in other softwoods is found on page 31 of the text.

3/ Excludes 4 million cubic feet of ponderosa pine in the Plains Region. The total net annual growth of ponderosa and Jeffrey pine in the United States is 483 million cubic feet.

4/ Excludes 16 million board feet of net growth of ponderosa pine in the Plains Region. The total net annual growth of ponderosa and Jeffrey pine in the United States is 1,857 million board feet.

Other softwoods comprise 25 percent of western sawtimber growth and 30 percent of growing-stock growth. This differential in growing-stock growth points toward an eventual higher proportion of these generally less desirable species in the sawtimber stand.

The growth of western hardwoods, although only 2 percent for sawtimber, comprises 5 percent of all western growing-stock growth.

Annual Growth Is Increasing

In 1920, the first published estimate of annual timber growth in the United States appeared in the Capper Report. Revised estimates were made for subsequent reports on the national timber situation as of 1930, 1936, and 1944:

Date	Report 1/	Annual Growth	
		Billion bd. ft.	Billion cu. ft.
1920	Capper	9.7	6.0
1930	Copeland	11.7	8.9
1938	Joint Committee	32.0	11.3
1944	Reappraisal	35.3	13.4
1952	Timber Resource Review	47.3	14.2

1/ For references see Chapter II, page 28.

For various reasons these periodic estimates of timber growth are not directly comparable. Changing standards and procedures which have affected periodic estimates of timber volume, as discussed in Chapter II, have likewise affected estimates of timber growth. In addition, there were changes in standards applying strictly to growth that were reflected in estimates made at different times. In some cases the change has been in the direction of an apparent increase and in others an apparent decrease in timber growth.

Factors tending to exaggerate the increase of annual growth that was probably taking place include the following: The decrease in the lower limit of sawtimber size in one region after another; the increase in allowable percentage of defect; the inclusion of species formerly omitted and scattered stands of sawtimber and much pole timber formerly overlooked. In addition to these factors, the crude estimate in the Capper report included only the growth on existing stands and took no account of the "ingrowth" of timber added to growing stock during the year of estimate. Working in the opposite direction is the change in this report to net growth after allowing for all losses from fire, insects, disease, and other causes.

Although direct comparison of the published estimates is not dependable, progress of the Forest Survey in recent years, including resurvey of much of the area previously surveyed, permits adjustment of the 1944 estimates to make them comparable to those for 1952:

Sawtimber Growth 1944 and 1952
(1944 data adjusted to 1952 standards)

		Total	Softwood	Hardwood
		Billion bd. ft.	Billion bd. ft.	Billion bd. ft.
North	1944	10.5	2.4	8.1
	1952	12.1	2.5	9.6
South	1944	21.3	12.8	8.5
	1952	24.0	14.5	9.5
West	1944	11.6	11.3	0.3
	1952	11.2	10.9	0.3
United States	1944	43.4	26.5	16.9
	1952	47.3	27.9	19.4

For the United States as a whole, sawtimber growth increased 9 percent between 1944 and 1952.

Softwood sawtimber growth increased 13 percent in the South, but only 4 percent in the North where New England experienced a decline. Hardwood sawtimber growth increased 15 percent, the increase being greater in the North than in the South.

In the West, softwood sawtimber growth dropped almost 4 percent. A severe outbreak of barkbeetles in the Northern Rocky Mountain Region is the major factor in this reversal of what might be expected. However, it should be pointed out that increased cutting of second-growth timber in the West is tending to offset new growth on early cutover lands. Furthermore, the increase of annual growth which is being generated by the more rapid cutting of old growth during the past 20 years will not have much effect on estimates of current annual growth for several decades.

The adjusted percentage increase in growing-stock growth was 14 percent, which was greater than that for sawtimber growth. This differential is especially significant in the East because it reflects the spread and improvement of organized protection from fire.

ANNUAL MORTALITY

Net annual growth as reported in the foregoing section is less than the amount of wood actually produced in the commercial forests because of losses from fire, insects, diseases, wind, and other causes. The amount, distribution, and rate of this annual mortality is the subject of this section.

Mortality Is One-fourth of Annual Growth

The annual mortality for 1952 is estimated at 12.5 billion board feet of sawtimber, or 3.5 billion cubic feet of growing stock (table 4). This estimate ascribes a loss to 1952 on the basis of current estimates tempered by known trends over a long period of years, exclusive of catastrophic losses. This concept is adopted to reduce the wide year-to-year impacts of severe fires or outbreaks of destructive insects and diseases.4/

The annual mortality of softwood sawtimber is about four times that of hardwood sawtimber (table 4 and fig. 3). However, softwood growing-stock mortality is not quite twice as great as hardwood growing-stock mortality. These relations are approximately the same as for timber volume.

Eighty percent of the softwood sawtimber losses are in the West; 30 percent in the Douglas-fir subregion alone. This is related to the concentration of softwood timber volume in the West, particularly in the Douglas-fir subregion, and to the high proportion of overmature timber in the West. Sixty percent of the hardwood sawtimber losses are in the North. This is a greater proportion than for timber volume because the rates of 1952 mortality (mortality as a percentage of timber volume) are higher in the North than elsewhere:

	All species	Softwood	Hardwood
	- - - - Percent of sawtimber volume - - - -		
North	0.78	1.03	0.71
South	0.50	0.53	0.46
West and Coastal Alaska	0.60	0.61	0.58

The high rate of <u>hardwood</u> mortality in the North is believed to be related to widespread incidence of heart rot in overmature northern hardwood and early susceptibility of aspen to stem canker. The differential in mortality rates for <u>softwoods</u> is even greater than for hardwoods. This is believed to be related to greater susceptibility of the northern species to windstorm and early susceptibility of balsam fir to heart rot.

4/ These estimates differ slightly from estimates of actual mortality experienced in 1952 as reported in the section on Forest Protection, Chapter IV. The differences were entirely in the Northern Rocky Mountain Region where insect losses in 1952 were greater than the trend level, and losses due to disease and weather and animals were slightly less. For more detail, see table 17 and tables 64 to 68, inclusive, in the Appendix.

Table 4.--Annual timber mortality, by section and region, 1952[1]
(United States and Coastal Alaska)

Section and region	Growing stock: Total	Growing stock: Softwood	Growing stock: Hardwood	Live sawtimber: Total	Live sawtimber: Softwood	Live sawtimber: Hardwood
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
North:						
New England	298	99	199	645	268	377
Middle Atlantic	233	64	169	354	115	239
Lake States	485	122	363	698	209	489
Central	102	4	98	312	13	299
Plains	28	2	26	70	5	65
Total	1,146	291	855	2,079	610	1,469
South:						
South Atlantic	95	64	31	267	191	76
Southeast	314	149	165	841	455	386
West Gulf	220	85	135	660	326	334
Total	629	298	331	1,768	972	796
West:						
Pacific Northwest:						
Douglas-fir subregion	551	537	14	3,105	3,056	49
Pine subregion	196	196	..	932	932	..
Total	747	733	14	4,037	3,988	49
California	359	336	23	1,865	1,811	54
Northern Rocky Mtn.	308	306	2	1,475	1,472	3
Southern Rocky Mtn.	200	179	21	906	849	57
Total	1,614	1,554	60	8,283	8,120	163
Total United States	3,389	2,143	1,246	12,130	9,702	2,428
Coastal Alaska	100	100	(2/)	392	392	(2/)
United States and Coastal Alaska	3,489	2,243	1,246	12,522	10,094	2,428

1/ Estimates represent the current level of mortality indicated by trends over a long period of years as determined in 1952. For more detailed statistics see Appendix tables 17 and 64. These estimates differ slightly from estimates of actual mortality experienced in 1952 as reported in the section on Forest Protection, Chapter IV.

2/ Less than 0.5 million.

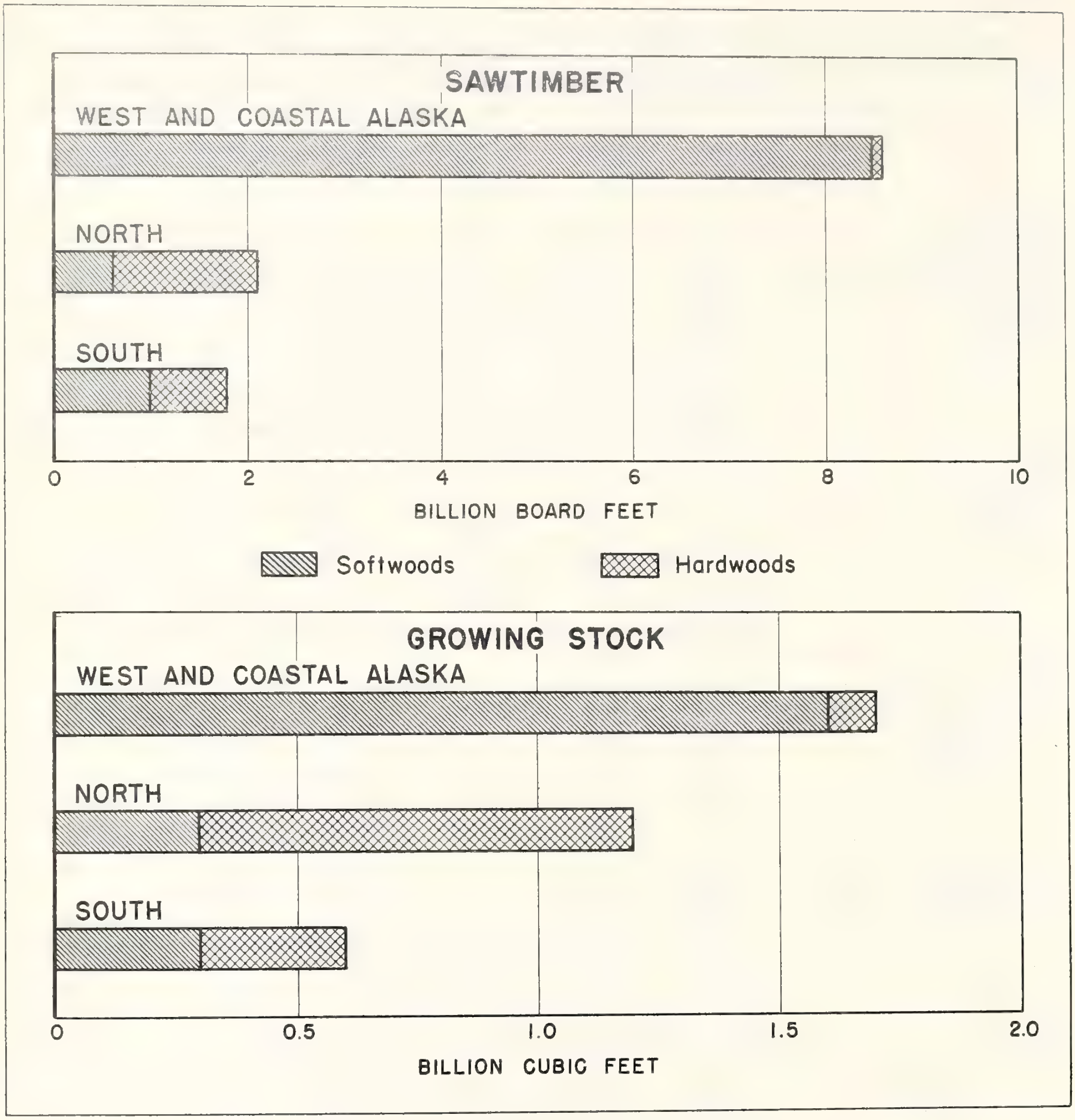


Fig. 3 - Annual timber mortality, 1952

Insects cause more loss than either fire or disease in the South and West (table 5). In contrast to this, disease causes more loss than either fire or insects in the North and in Coastal Alaska.

Causes other than fire, insects, and disease account for 37 percent of all sawtimber mortality and 43 percent of growing-stock mortality. These proportions are higher in the East than in the West. These losses include those from suppression and senility as well as those from windstorm, ice, animals, etc.5/

Reduction of mortality from fire, insects, and disease is implicit in the more comprehensive and more intensive protection which is being provided for our forest lands. Reduction of mortality--especially from insects which attack mature timber and from endemic diseases--is also implicit in the more intensive management which is being so widely applied on public and industrial forest holdings in the present economic climate.

5/ Causes of mortality and the full impact of these losses on growth are more fully discussed in the section on Forest Protection, Chapter IV.

Table 5.--Annual mortality of growing stock and live sawtimber, by cause and by section, 1952[1] (United States and Coastal Alaska)

GROWING STOCK

Cause	North	South	West	Coastal Alaska	Total, United States and Coastal Alaska
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
Fire	36	126	73	1	236
Insects	65	112	766	27	970
Disease	461	73	190	49	773
Other[2]	584	318	585	23	1,510
Total	1,146	629	1,614	100	3,489

SAWTIMBER

Cause	North	South	West	Coastal Alaska	Total, United States and Coastal Alaska
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Fire	71	294	414	2	781
Insects	99	412	4,224	98	4,833
Disease	914	233	928	204	2,279
Other[2]	995	829	2,717	88	4,629
Total	2,079	1,768	8,283	392	12,522

1/ Estimates represent the current level of mortality indicated by trends over a long period of time as determined in 1952. These estimates differ slightly from estimates of actual mortality experienced in 1952 as reported in the section on Forest Protection, Chapter IV. The differences were entirely in the Northern Rocky Mountain Region in the West where insect losses in 1952 were greater than the trend level and losses due to disease and weather and animals were slightly less.

2/ Weather, animals, suppression, etc.

TIMBER PRODUCTS OUTPUT AND TIMBER CUT

It is encouraging to note that, for the country as a whole, there have been substantial gains in timber growth in recent years. Something of the adequacy of this growth can be learned from consideration of the quantity, kind, quality, and distribution of current timber cut.

The following analysis deals primarily with timber depletion due to cutting. Its purpose is to present statistics on output and source of timber products and analyze timber cut.

TIMBER PRODUCTS OUTPUT

The American people use great quantities of lumber, pulpwood, and other timber products each year. Imports, though sizable in pulp and paper products, are not large in comparison with total needs. Most of the needs are supplied by our own forests. But not all the domestic output constitutes a drain on our commercial timber inventory. Some of it is obtained from noncommercial forest land, some comes from salvage of dead and cull trees, some is taken from trees below the minimum sizes included in growing-stock inventory or from tops or limbs not included in the inventory. In addition to these roundwood sources, residues from the manufacture of certain products (such as lumber and veneer) are used as raw materials for other products (such as woodpulp) or as fuel. Thus, the term "timber products output" refers to the total output of timber products from all domestic raw-material sources.

More than 11 billion cubic feet of logs and bolts were harvested for timber products in 1952 (table 6). Of this amount, 9.4 billion cubic feet was from growing stock and 1.7 billion cubic feet, or 15 percent, came from cull and dead trees and other roundwood sources not included in growing stock. About half of the timber harvested for fuelwood, one-third of that for fence posts, and about one-tenth of the pulpwood and round mine timbers came from these supplementary sources, thus constituting a direct saving of growing stock which would otherwise have been required.

Use of plant residues also contributed significantly to total output. For every cord of fuelwood harvested as roundwood, the equivalent of more than one additional cord came from plant residues. Plant residues supplied the equivalent of 31.4 million cords of fuelwood. They also supplied the equivalent of 1.6 million cords of pulpwood or 6 percent of the total output. Thirty million board feet of lumber and 59 million cubic feet of miscellaneous products were likewise obtained from plant residues.

More Timber Harvested for Sawlogs Than for All Other Products Combined

Sawlogs for lumber, timbers, sawn ties, etc. comprised 55 percent of all the roundwood utilized for timber products in 1952 (table 6). Fuelwood, pulpwood, and veneer logs and bolts came next in order, with 18, 16, and 4 percent respectively. Together these four products accounted for almost 94 percent of the total. They also account for

Table 6.--Output and source of timber products in the United States and Coastal Alaska, by product, 1952

Product	Domestic output 1/: Standard unit	Domestic output 1/: Total	Domestic output 1/: From plant residues	Output from roundwood: Total	Output from roundwood: Growing stock	Output from roundwood: Cull, dead trees, etc. 2/
		Million units	Million units	Million cu. ft.	Million cu. ft.	Million cu. ft.
Sawlogs (for lumber, timbers, sawn ties, etc.)	Board-foot lumber tally	39,510	30.2	6,146	5,801	345
Veneer logs and bolts	Board-foot log scale	2,467	..	422	392	30
Cooperage logs and bolts	do.	355	..	73	72	1
Pulpwood	Standard cords	25	1.6	1,823	1,656	167
Fuelwood	do.	59	31.4	2,008	966	1,042
Piling	Linear feet	41	..	28	28	(4/)
Poles	Pieces	6	..	88	88	(4/)
Posts (round and split)	do.	306	.1	194	127	67
Hewn ties	do.	10	..	67	66	1
Mine timbers (round)	Cubic feet	81	(3/)	81	72	9
Other 5/	do.	227	59.0	168	125	43
Total		..	..	11,098	9,393	1,705

1/ Estimates of timber products output include both roundwood and plant residues. The Bureau of the Census customarily compiles production statistics for lumber, veneer, and plywood (including consumption of logs and bolts) and pulpwood. However, for 1952 only pulpwood output was obtained solely from this source. In the case of veneer logs and bolts the estimate for hardwoods and eastern softwoods was derived from the Census estimate of logs and bolts consumed for veneer and plywood adjusted for changes in stocks and net imports. The same procedure was followed for western softwoods for the portion of output included in the Census estimate which related only to logs and bolts produced or consumed by established plywood plants. The volume of logs and bolts produced independently of integrated plywood operations and manufactured into veneer, whether for plywood, containers, or other uses was estimated separately by the Forest Service. The Census estimates of 1952 lumber production for the West was used as overall control except in California where more complete data from other sources showed a slightly higher output. In the fall of 1953, it became apparent that the Census estimate for the East would not be available in time for use in the Timber Resource Review. (Actually, its preliminary estimate was not released until November 1954.) Accordingly, special studies involving the use of data supplied by State foresters, compiled for tax purposes and available from various other sources including field surveys where necessary, were undertaken to provide these needed statistics. For the country as a whole, the Timber Resource Review estimate of 1952 lumber production is about 5 percent above the total reported by the Bureau of the Census.

2/ In addition to cull and dead trees, includes trees of commercial species less than 5.0 inches in diameter and tops less than 4.0 inches in diameter, and trees from noncommercial forest land.

3/ Less than 0.05 million.

4/ Less than 0.5 million.

5/ Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and bolts for other miscellaneous products.

94 percent of the output from growing stock, although here fuelwood drops to third place because of the large proportion of output obtained from dead and cull trees, etc.

The sawlog output representing 39.5 billion board feet of lumber in 1952 was greater than it had been for 25 years (fig. 4). The 1952 pulpwood output of 25 million cords equalled the alltime record reached in 1951. Pulpwood output has been rising in all sections of the United States, but particularly in the South, where it is now about half as large as the sawlog output. The output of veneer logs and bolts was likewise at an alltime record. In contrast, the trend of fuelwood output is sharply downward.

TIMBER CUT

Statistics of timber products output serve as a measure of the importance of the forest products industries in national industrial activity. For appraising the long-range timber supply situation, however, we need to translate output statistics into terms of timber cut.

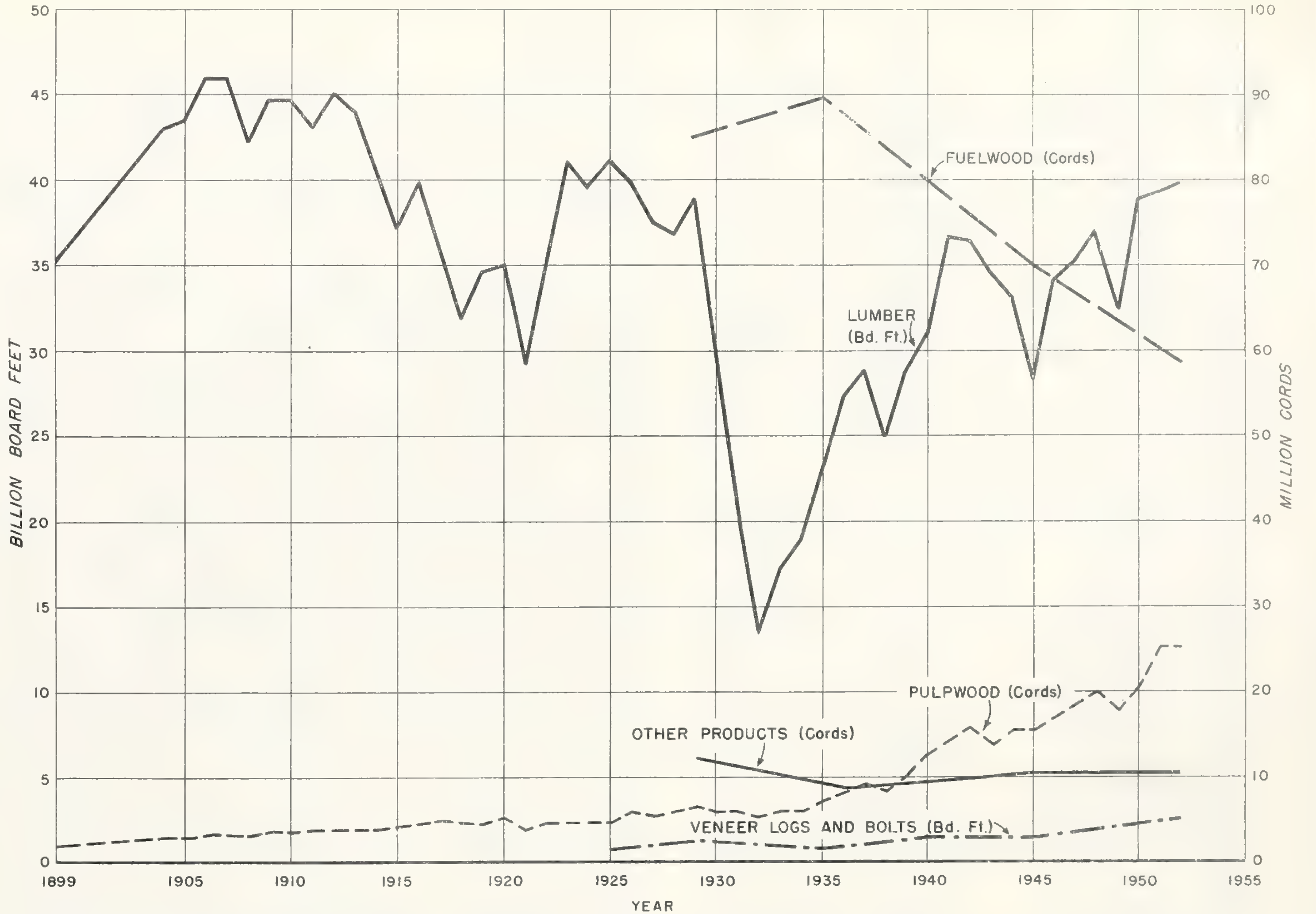
Timber cut as used here includes not only the roundwood volume of timber products cut from growing-stock inventory (table 6) but also the volume of growing stock cut, knocked down, or otherwise killed in logging and left unused in the woods (logging residues).6/

Anyone familiar with developments in timber harvesting will agree that improved practices and higher prices for timber products have made for closer utilization of the timber cut in recent years. Yet a substantial volume of the timber cut is never brought out of the woods. In 1952, logging residues amounted to almost 1.4 billion cubic feet or 13 percent of the total growing stock cut (table 7 and fig. 5). Logging residues are discussed more fully in a later section (see page 50).

Major Dependence Is on Sawtimber

Sawtimber has always been the backbone of the Nation's timber economy. In 1952, it comprised 84 percent of the 10.8 billion cubic feet of timber cut (table 7). Pole timber contributed only 16 percent. The preponderance of sawtimber in total cut is, of course, understandable in the light of present low minimum sizes for sawtimber—9 inches for eastern softwoods and 11 inches for all other species. But it is worth emphasizing that even for products which do not require trees of sawtimber size, much of the cut is from sawtimber: Pulpwood, 56 percent; fuelwood, 53 percent; fence posts, 34 percent; and round mine timbers, 30 percent. The proportion of the cut of pulpwood coming from poletimber is undoubtedly increasing as supplies of larger size are less readily available to meet the increasing demand. Nevertheless, it generally costs less to cut pulpwood from trees over 9 inches in diameter in the East or 11 inches in the West than from trees below these sizes.

6/ Timber cut is the equivalent of commodity drain in the 1945 Reappraisal.



SOURCE: Bureau of the Census, U. S. Department of Commerce and Forest Service, U. S. Department of Agriculture

Fig. 4 — Output of forest products in continental United States, 1899—52

Table 7.--Timber cut, by product and class of material, 1952 (United States and Coastal Alaska)

Product	Growing stock			Sawtimber			Poletimber		
	Total cut	Timber products	Logging residues	Total cut	Timber products	Logging residues	Total cut	Timber products	Logging residues
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
Sawlogs (for lumber, timbers, sawn ties, etc.)	6,821	5,801	1,020	6,566	5,624	942	255	177	78
Veneer logs and bolts	492	392	100	489	391	98	3	1	2
Cooperage logs and bolts	105	72	33	103	70	33	2	2	(1/)
Pulpwood	1,728	1,656	72	975	922	53	753	734	19
Fuelwood	1,004	965	39	537	500	37	467	465	2
Piling	32	28	4	31	27	4	1	1	(1/)
Poles	102	88	14	92	79	13	10	9	1
Posts (round and split)	131	127	4	44	41	3	87	86	1
Hewn ties	108	67	41	106	66	40	2	1	1
Mine timbers (round)	77	72	5	23	21	2	54	51	3
Other 2/	157	125	32	103	76	27	54	49	5
Total	10,757	9,393	1,364	9,069	7,817	1,252	1,688	1,576	112

1/ Less than 0.5 million.
2/ Includes box and shingle bolts, excelsior bolts, turnery, dimension, and handle stock, chemical wood, and bolts for other miscellaneous products.

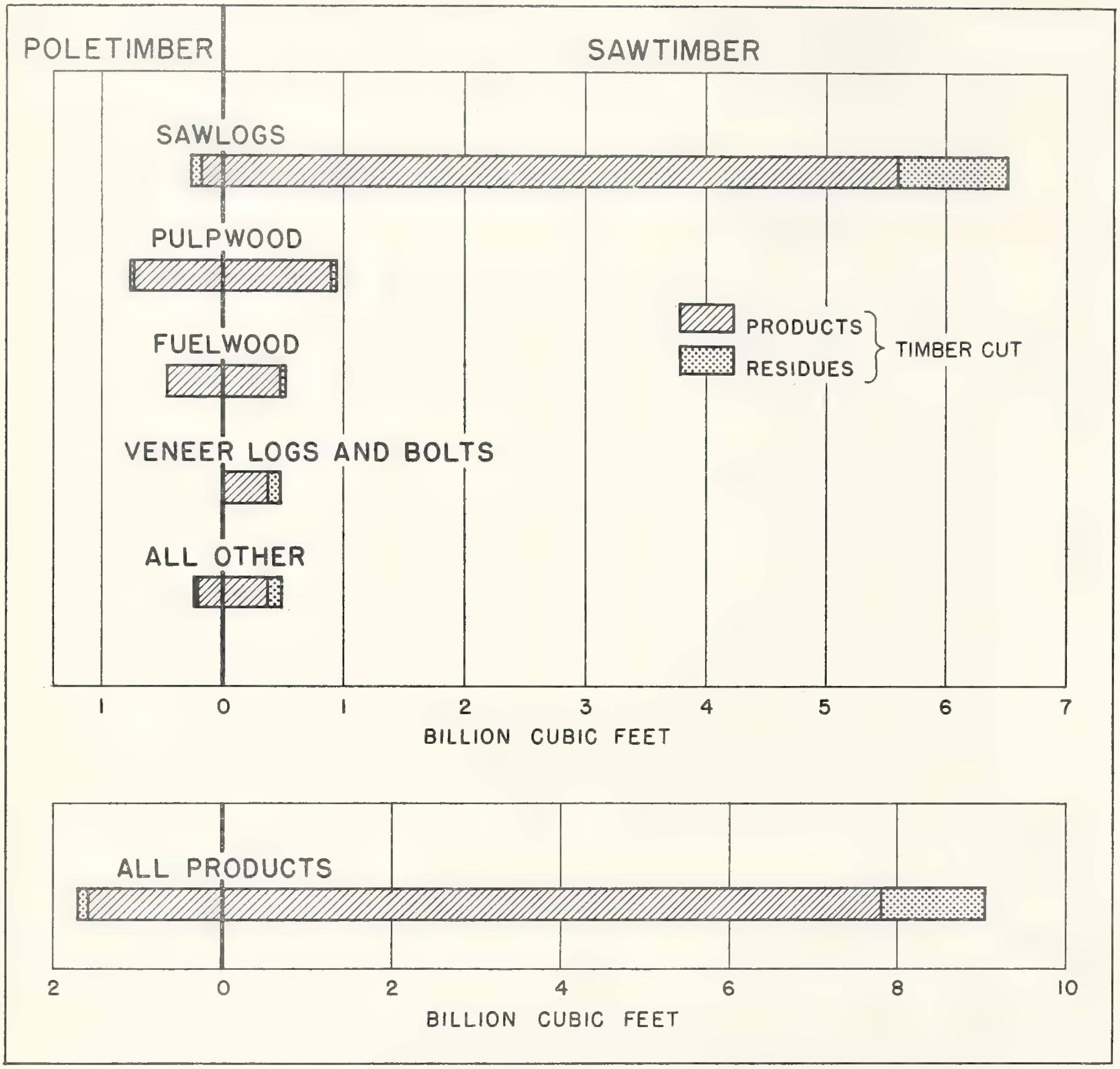


Fig. 5 - Timber cut, timber products, and logging residues, 1952

Only a limited amount of poletimber appears in the cut of products normally requiring trees of sawtimber size. Much of this consists of trees knocked down, broken, or otherwise killed in the course of logging rather than trees actually cut for timber products. Nevertheless, 4 percent of the sawlog output comes from trees nominally below sawtimber size.

The West Leads in Timber Cut for Sawlogs and Veneer, the South for Pulpwood and Fuelwood

Because of the preponderance of large sawtimber, the West dominates the cut for sawlogs and veneer logs and bolts. A little more than half the timber cut for these products, as well as 16 percent of the timber cut for pulpwood, originates here.

Major Items of Timber Cut, 1952

	Sawlogs	Pulpwood	Fuelwood	Veneer logs and bolts
	Billion bd. ft.	Million cords	Million cords	Billion bd. ft.
North	4.7	5.7	3.9	0.3
South	13.3	13.2	9.4	1.0
West and Coastal Alaska	18.6	3.5	0.3	1.5
Total	36.6	22.4	13.6	2.8

The South is foremost in pulpwood production as a result of a number of conditions favoring development of the pulp and paper industry in this section, including good location with respect to the Nation's principal markets, available supplies of relatively cheap southern pine timber, reasonable security of future raw-material supplies based upon rapid tree growth, ample supplies of relatively cheap labor, water resources, chemicals and power, and excellent rail, water, and highway transportation facilities. More timber is cut for fuelwood in the South chiefly because the rural people, by virtue of their generally low economic status, have sustained the use of wood fuel to a much greater extent than in other parts of the country.

The North accounts for 70 percent of the timber cut for round mine timbers--the only instance where the timber cut is greater in the North than in the South. However, sawlogs for lumber represent the chief product here as elsewhere, and the North surpasses the West in timber cut for pulpwood and fuelwood, and for some minor items like cooperage, fence posts, hewn ties, etc.

When all products are combined, the West shows up in the lead in sawtimber cut, whereas the South is foremost in growing stock cut (table 8). About 22.5 billion board feet or 46 percent of the Nation's sawtimber cut in 1952 came from the West and Coastal Alaska, as compared to

Table 8.--Timber cut, by section and region, and by class of material, 1952
(United States and Coastal Alaska)

Section and region	Growing stock: Timber cut	Growing stock: Timber products	Growing stock: Logging residues	Cut from poletimber	Cut from sawtimber	
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.
North:						
New England	500	455	45	114	386	1,768
Middle Atlantic	470	412	58	107	363	1,795
Lake States	537	474	63	271	266	1,240
Central	405	362	43	112	293	1,809
Plains	28	25	3	10	18	94
Total	1,940	1,728	212	614	1,326	6,706
South:						
South Atlantic	1,455	1,262	193	307	1,148	5,352
Southeast	2,405	2,077	328	476	1,929	9,411
West Gulf	1,193	1,008	185	230	963	4,836
Total	5,053	4,347	706	1,013	4,040	19,599
West:						
Pacific Northwest:						
Douglas-fir subregion	2,031	1,838	193	13	2,018	12,221
Pine subregion	359	321	38	3	356	2,050
Total	2,390	2,159	231	16	2,374	14,271
California	932	765	167	8	924	5,724
Northern Rocky Mtn.	329	296	33	27	302	1,899
Southern Rocky Mtn.	100	87	13	10	90	555
Total	3,751	3,307	444	61	3,690	22,449
Total United States	10,744	9,382	1,362	1,688	9,056	48,754
Coastal Alaska	13	11	2	1/	13	86
United States and Coastal Alaska	10,757	9,393	1,364	1,688	9,069	48,840

1/ Less than 0.5 million.

19.6 billion (40 percent) from the North. On the other hand, the growing stock cut in the South in 1952 amounted to 5 billion cubic feet or 47 percent of the Nation's total. In comparison, 35 percent of the growing stock cut was in the West and Coastal Alaska, and 18 percent in the North.

The differences in the ranking of the sections in sawtimber cut and in growing stock cut are due to the much larger average age of the timber cut in the West and to the proportion of the cut taken from sawtimber and from poletimber. In the West, practically the entire cut is from sawtimber. In the South, on the other hand, 20 percent of the cut is from poletimber. In the North, as much as 32 percent of the cut is from poletimber and, in the Lake States Region where large timber is scarce, the cut of poletimber actually exceeds the cut of sawtimber.

Timber Cut Is Predominantly Softwoods

For the country as a whole, softwoods account for 70 percent of growing stock cut and 75 percent of the sawtimber cut (table 9 and fig. 6). The fact that the Nation's timber needs are pretty much geared to softwoods might logically be expected inasmuch as softwoods predominate in most sections of the country and are preferred for most products. In the West, of course, practically the entire supply consists of softwoods. In the South, about three-fifths of the cut is softwoods, whereas softwoods in the sawtimber inventory barely exceed hardwoods and are definitely in the minority in the growing-stock inventory. In the North, hardwoods are in greater abundance, a fact which is further reflected in timber cut. Nevertheless softwoods in the North are likewise supplying a greater proportion of the cut in relation to inventory volume than hardwoods, thus reflecting a continued preference for softwoods here as elsewhere.

Of the timber cut for sawlogs (6.8 billion cubic feet), about 77 percent was softwoods. Poles and piling were almost all softwood. Pulpwood, formerly almost entirely cut from softwood, is now 16 percent hardwood. Veneer logs and bolts are about half softwoods and half hardwoods.

Hardwoods were cut more exclusively for several products. For example, hardwoods accounted for 75 percent of timber cut for mine timbers, 72 percent for cooperage, and 70 percent for hewn ties.

Because of their abundance and utility, Douglas-fir and the southern yellow pines made up almost half of all the timber cut in 1952 (table 10 and fig. 7). The oaks and the soft hardwoods (yellow poplar, soft maple, sweetgum, tupelo and blackgum, cottonwood and aspen, and basswood) each constituted about 10 percent of the total cut and were next in order of importance.

In the North, hardwoods accounted for 4.3 billion board feet or 65 percent of the total cut of sawtimber (table 11). Of the hardwoods, the cut by species was oaks 37 percent, yellow birch, beech, and hard maple 27 percent, yellow poplar and other soft hardwoods 24 percent,

Table 9.--Timber cut by softwoods and hardwoods, and by product, 1952
(United States and Coastal Alaska)

Product	Growing stock			Live sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Sawlogs (for lumber, timbers, sawn ties, etc.)	6,821	5,214	1,607	36,636	28,890	7,746
Veneer logs and bolts	492	251	241	2,803	1,575	1,228
Cooperage logs and bolts	105	29	76	516	143	373
Pulpwood	1,728	1,460	268	4,693	4,252	441
Fuelwood	1,004	243	761	2,246	595	1,651
Piling	32	30	2	159	148	11
Poles	102	101	1	470	466	4
Posts (round and split)	131	49	82	218	69	149
Hewn ties	108	32	76	483	152	331
Mine timbers (round)	77	19	58	100	41	59
Other 1/	157	59	98	516	215	301
Total	10,757	7,487	3,270	48,840	36,546	12,294

1/ Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and bolts for other such miscellaneous products.

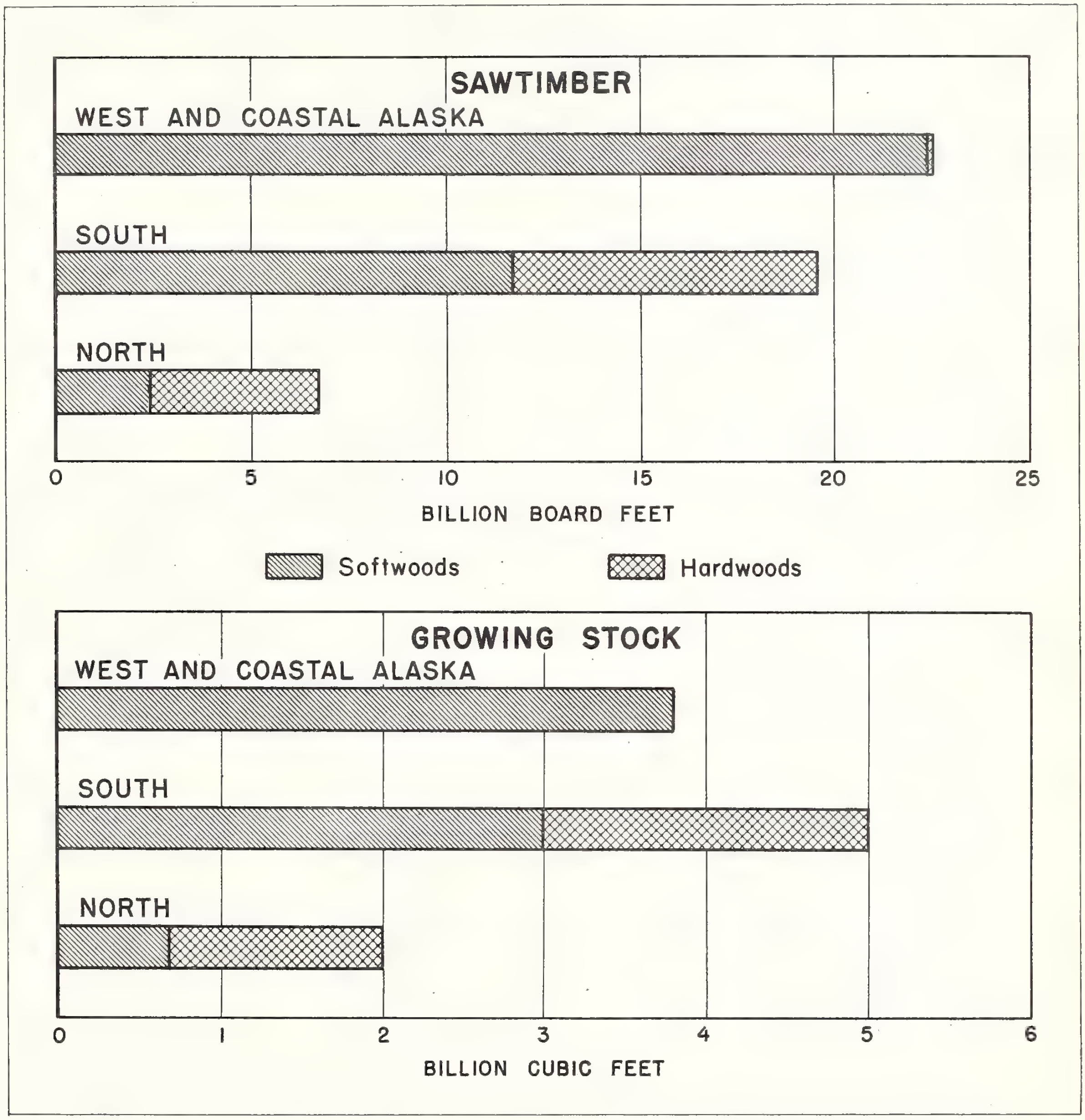


Fig. 6 - Timber cut, 1952

Table 10.--Timber cut, by species group, 1952[1]
(United States and Coastal Alaska)

Species group[2]	Growing stock	Live sawtimber
	Million cu. ft.	Million bd. ft.
Eastern species:		
Softwood:		
White, red, and jack pine	257	972
Southern yellow pine	3,029	11,610
Spruce-fir	243	668
Other softwoods	217	841
Total softwoods	3,746	14,091
Hardwood:		
Yellow-poplar	217	988
Other soft hardwoods	1,055	3,892
Total	1,272	4,880
Oak	1,292	4,894
Beech-yellow birch-hard maple	325	1,290
Other hard hardwoods	358	1,150
Total	1,975	7,334
Total hardwoods	3,247	12,214
Total, Eastern species	6,993	26,305
Western species:		
Softwoods:		
Douglas-fir	1,966	11,962
Ponderosa and Jeffrey pine	605	3,603
Western hemlock	377	2,225
White and sugar pine	97	609
Redwood	163	987
Other softwoods	533	3,069
Total softwoods	3,741	22,455
Hardwoods	23	80
Total, Western species	3,764	22,535
All softwoods	7,487	36,546
All hardwoods	3,270	12,294
All species	10,757	48,840

1/ Timber cut by species groups and regions is shown in tables 13, 14, and 15, pages 42, 44, and 45 of this report and in the Summary of Basic Statistics, tables 47, 48, 51, and 52 of the Appendix.

2/ Reference to the more important species in other softwoods, other soft hardwoods, and other hard hardwoods is found on page 31 of this report.

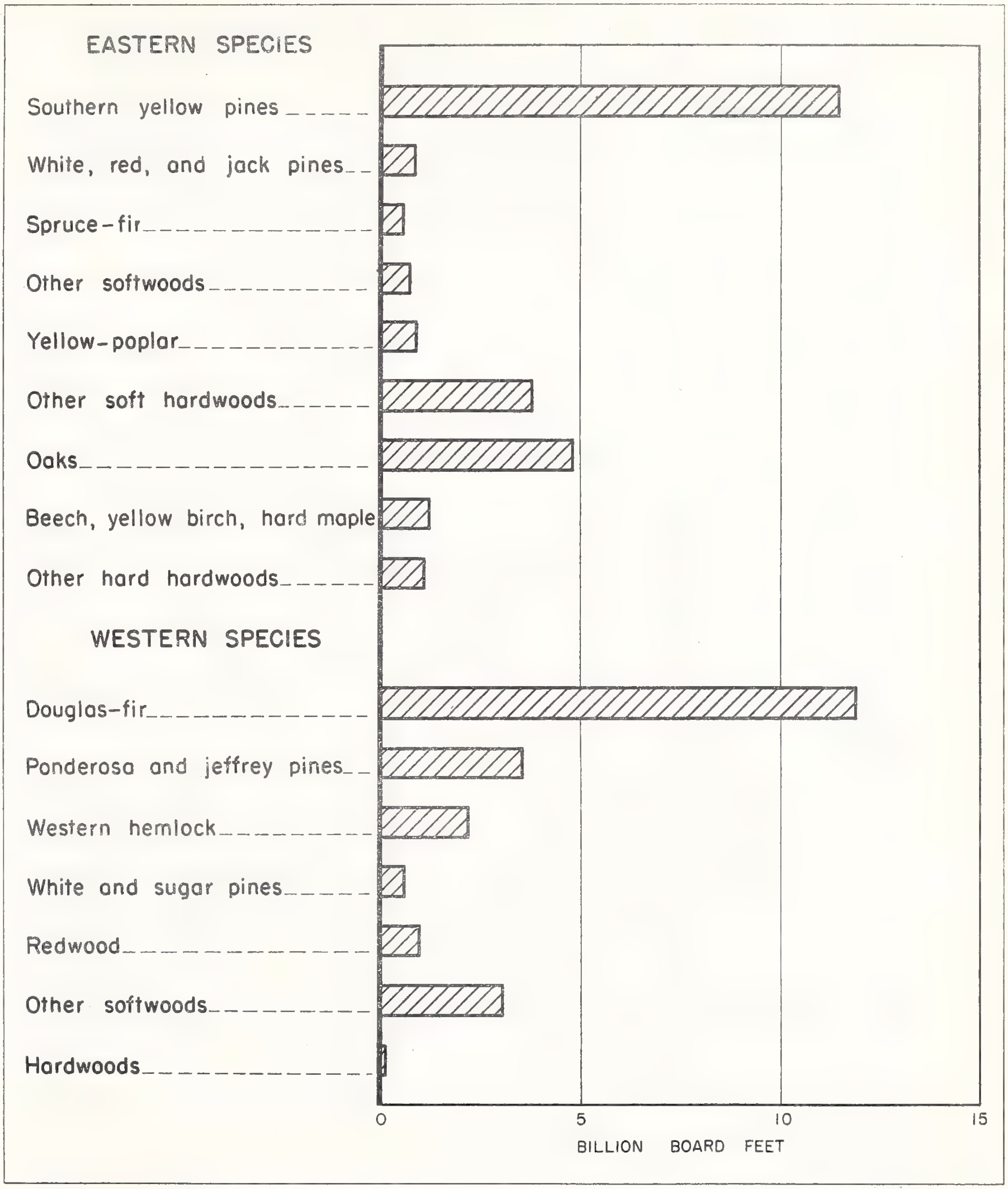


Fig. 7 — Distribution of cut of live sawtimber by species group, 1952

Table 11.--Timber cut by softwoods and hardwoods, and by section and region, 1952 (United States and Coastal Alaska)

Section and region	Growing stock			Live sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
North:						
New England	500	361	139	1,768	1,381	387
Middle Atlantic	470	130	340	1,795	508	1,287
Lake States	537	188	349	1,240	384	856
Central	405	17	388	1,809	85	1,724
Plains	28	4	24	94	12	82
Total	1,940	700	1,240	6,706	2,370	4,336
South:						
South Atlantic	1,455	916	539	5,352	3,360	1,992
Southeast	2,405	1,479	926	9,411	5,724	3,687
West Gulf	1,193	651	542	4,836	2,637	2,199
Total	5,053	3,046	2,007	19,599	11,721	7,878
West:						
Pacific Northwest:						
Douglas-fir subregion	2,031	2,022	9	12,221	12,169	52
Pine subregion	359	359	(1/)	2,050	2,050	(1/)
Total	2,390	2,381	9	14,271	14,219	52
California	932	921	11	5,724	5,704	20
Northern Rocky Mtn.	329	328	1	1,899	1,897	2
Southern Rocky Mtn.	100	98	2	555	549	6
Total	3,751	3,728	23	22,449	22,369	80
Total, United States	10,744	7,474	3,270	48,754	36,460	12,294
Coastal Alaska	13	13	..	86	86	..
United States and Coastal Alaska	10,757	7,487	3,270	48,840	36,546	12,294

1/ Less than 0.5 million.

and ash, hickory, walnut and other hard hardwoods 12 percent (table 13, page 42). White, red, and jack pine were the principal softwoods. This group made up 39 percent of the softwoods cut, spruce and fir 28 percent, the southern yellow pines 11 percent, and other softwoods including hemlock and larch 22 percent.

The cut of hardwoods was greatly in excess of softwoods in all northern regions except New England. The oaks were the principal hardwoods cut in the Middle Atlantic, Central, and Plains Regions. Yellow birch, beech, and hard maple made up 39 percent of the hardwoods cut in the Lake States, and the soft hardwoods, chiefly aspen for pulp, 30 percent.

Softwoods cut in the Central and Plains Regions were chiefly the southern yellow pines. In the Lake States, about 42 percent of total softwoods was white, red, and jack pine, 46 percent other softwoods, mainly hemlock and larch, and 12 percent spruce and fir.

In contrast to other northern regions, nearly four-fifths of the cut in New England was softwoods. About one-half was white, red, and jack pine and one-half spruce and fir. The principal hardwoods cut were yellow birch, beech, and hard maple.

<u>In the South</u>, the southern yellow pines accounted for practically the entire cut of softwoods (table 14, page 44). These species have for years been one of the country's mainstays for lumber and now assume this role also for pulp. In addition, they are in considerable demand for poles, piling, and container veneer, and supply the Nation's entire output of naval stores. The oaks contributed 42 percent of the hardwood cut, yellow poplar 10 percent, other soft hardwoods 38 percent, and other hard hardwoods 10 percent.

The relationship of cut by species is about the same in each of the southern regions as in the South as a whole. As would be indicated by its occurrence, the cut of yellow poplar is confined chiefly to the South Atlantic and Southeastern Regions. The oaks supply one-half the total hardwood cut in the West Gulf as compared to two-fifths in the other two regions.

<u>In the West</u>, about 53 percent of the total cut was Douglas-fir (table 15, page 45). Like the southern yellow pines, this species is used principally for lumber, but substantial quantities are used for veneer, pulp, poles and piling, and a variety of other products. Because of its great utility and because most of it is old-growth quality timber, it is considered to be the most widely used commercial species in the world.

Ponderosa and Jeffrey pine accounted for 16 percent of timber cut in the West. Containers, plywood, and millwork items are important uses. Next in order were western hemlock, primarily for pulp (10 percent), redwood for lumber specialties (4 percent), and white and sugar pine (3 percent) also for specialty use such as mouldings and patterns, matches, and sash and door stock. The group of "other softwoods," including such species as the true firs for lumber, Sitka spruce for lumber and cooperage, western red cedar for shingles and poles, lodgepole pine for mine timbers and poles, made up 14 percent of the cut.

The cut by species in various western regions occupies about the same order of dominance as does sawtimber volume. Thus Douglas-fir comprises 72 percent of the total cut in the Douglas-fir subregion--western hemlock 18 percent; Ponderosa pine 66 percent in the pine subregion--Douglas-fir 18 percent. A similar relationship holds in California, Northern Rocky Mountain, and Southern Rocky Mountain Regions. In Coastal Alaska, however, the cut has been heaviest in the minority species. This is because lumber has been the principal product for which spruce and fir have been in greatest demand. Western hemlock with the most volume is just now coming into prominence for pulp.

An Increasing Proportion of the Nation's Timber Cut Has Come from the West

Data from various national studies dating from 1920 signify that the West has steadily assumed an increasingly larger share of the timber cut. In 1952, the West supplied 46 percent or about 20 percent more sawtimber than was cut in 1944. A similar trend is apparent in growing stock cut, although the West's contribution averages about 11 percent lower.

Timber Cut Selected Years, 1920-1952 1/

Date	Report 2/	United States	West	Percent
		Billion bd. ft.	Billion bd. ft.	
1920	Capper Report	56.1	..	..
1930	Copeland Report	54.6	18.5	34
1938	Joint Committee	42.4	14.5	34
1944	Reappraisal	49.7	18.8	38
1952	Timber Resource Review	48.8	22.5	46

1/ Timber cut is not to be confused with timber drain as reported in the 1944 Reappraisal and previous national studies, since the drain estimates included not only the amount due to cutting for commodities but also losses from fire, epidemics of insects and disease, wind, ice, and other destructive agents. For purposes of comparability, only the volume due to cutting in these various periods is listed here.

2/ For references, see Chapter II, page 28.

Periodic estimates of timber cut are more nearly comparable than similar estimates of annual growth and even timber volume where changing standards, definitions, and concepts result in considerable differences from one period to another. Changing standards, such as size criteria for sawtimber, have not affected the estimates of timber cut appreciably.

Although output of major products has increased, the total cut of sawtimber in 1952 of 48.8 billion board feet was not significantly different from the cut in 1944 of 49.7 billion board feet.

Timber Cut -- 1944-1952

		Total	Softwood	Hardwood
		Billion bd. ft.	Billion bd. ft.	Billion bd. ft.
North	1944	8.3	2.8	5.5
	1952	6.7	2.4	4.3
South	1944	22.6	14.1	8.5
	1952	19.6	11.7	7.9
West	1944	18.8	18.7	0.1
	1952	22.5	22.4	0.1
United States	1944	49.7	35.6	14.1
	1952	48.8	36.5	12.3

The decrease in hardwoods cut between 1944 and 1952 was due in a large measure to a declining use of fuelwood and to generally adverse conditions in hardwood lumber markets since the war. The strong demand for lumber and pulp was responsible for the increased cut of softwoods. Not reflected in the figure for softwoods is the considerable cut of dead and cull trees and plant residues used for fuel and pulp, which tended to hold down the cut of live sawtimber to a level lower than it might otherwise have been.

The increase in the cut of softwood sawtimber was only in the West. The cut rose 20 percent here, reflecting, for the most part, an increase in California where the cut more than doubled between 1944 and 1952. In addition, substantial percentage increases took place in the two Rocky Mountain Regions in response to the strong demand for softwood lumber. The rising trend in the West will ultimately be reversed as the old growth comes to an end following the pattern characteristic of the Northeast, the Lake States, and the South. The South will hold important advantages when the forest economy of the West, like other sections of the country, is based primarily on second-growth timber. The fact that the Pacific Northwest showed no increase for the period signifies, perhaps, that western production may be reaching its peak.

In contrast to the West, the cut of softwood sawtimber dropped about 16 percent in both the South and North. Of the three southern regions, the West Gulf suffered the largest decrease. The decline in the South, as a whole, is particularly significant in view of the greatly increased pulp-mill capacity brought into operation during the period. The resulting increase in softwood cut for pulp, from 7.2 to 12.8 million cords between 1944 and 1952 is therefore indicated as being almost entirely from poletimber.

The decrease in the cut of softwood sawtimber in the North was more pronounced in the Lake States than elsewhere, reflecting the general scarcity of the larger timber in this region.

COMPARISON OF GROWTH AND CUT

In an overall comparison for the country as a whole, it appears that sawtimber growth is not quite equal to cut but that growth of growing stock is 33 percent in excess of growing stock cut (table 12 and fig. 8).

In the near-balance for sawtimber, a growth deficiency of 8-1/2 billion board feet of softwoods is largely hidden by a surplus of over 7 billion board feet of hardwood growth, most of which is in the North. Similarly, in the near-balance for sawtimber, a 10 billion board-foot excess of growth over cut in the East is offset by an 11 billion board-foot deficit in the West.

These figures indicate how misleading an overall comparison of growth and cut may be. For one thing, the significance of the comparison is quite different in the West, where there is still a large volume of old-growth timber, than it is in the East where a balance of growth and cut is of much more significance.

Even where applied to specific local or regional situations, comparisons of growth and cut must be interpreted with caution. The level at which comparisons are made are extremely important. Situations, for example, where cutting is less than formerly because of limited merchantable timber or other reasons, are more likely to show favorable relations between growth and cut. On the other hand, situations where cutting is at a high level because of active and diversified demand or remaining old growth are more likely to show unfavorable relations.

The final criterion, as developed in Chapter VII, Future Supply and Quality of Domestic Timber, is a balancing of annual timber growth of appropriate species and tree size with timber cut needed to meet future requirements. Nevertheless, analysis of current growth-cut relations is significant since it shows whether growth is increasing at a rate necessary to meet expected increases in cut.

Softwood Growth Exceeds Timber Cut in the East

In the East, annual growth of softwoods, as well as that of hardwoods, exceeds the corresponding timber cut for both growing stock and sawtimber. In the North the margin for softwood sawtimber is 4 percent, in the South 24 percent. This favorable balance for softwood sawtimber in the East is one of the most significant findings of this report. It augurs well for the future. Nevertheless these favorable balances are of less significance than they would have been if timber cut in both North and South had not declined since the war. The balances have been achieved as much by reducing cut as by increasing annual growth. Both growth and cut are far below the productive capacity of the land.

Table 12.--Comparison of net annual timber growth and timber cut, 1952[1]
(United States and Coastal Alaska)

Species group and section	Growing stock: Growth	Growing stock: Cut	Growing stock: Ratio of growth to cut	Live sawtimber: Growth	Live sawtimber: Cut	Live sawtimber: Ratio of growth to cut
	Billion cu. ft.	Billion cu. ft.		Billion bd. ft.	Billion bd. ft.	
All species:						
North	4.6	1.9	2.42	12.1	6.7	1.80
South	6.8	5.1	1.33	24.0	19.6	1.22
West and Coastal Alaska	2.8	3.7	.76	11.3	22.5	.50
Total	14.2	10.7	1.33	47.4	48.8	.97
Softwood:						
North	.8	.7	1.14	2.5	2.4	1.04
South	3.6	3.1	1.16	14.5	11.7	1.24
West and Coastal Alaska	2.6	3.7	.70	11.0	22.4	.49
Total	7.0	7.5	.93	28.0	36.5	.77
Hardwood:						
North	3.8	1.2	3.17	9.6	4.3	2.23
South	3.2	2.0	1.60	9.5	7.9	1.20
West and Coastal Alaska	.2	(2/)	..	.3	.1	3/3.30
Total	7.2	3.2	2.25	19.4	12.3	1.58

1/ Comparisons by regions are given in Appendix tables 58 to 62, inclusive.
2/ Less than 0.05 billion cubic feet.
3/ Before rounding to nearest 0.1 billion.

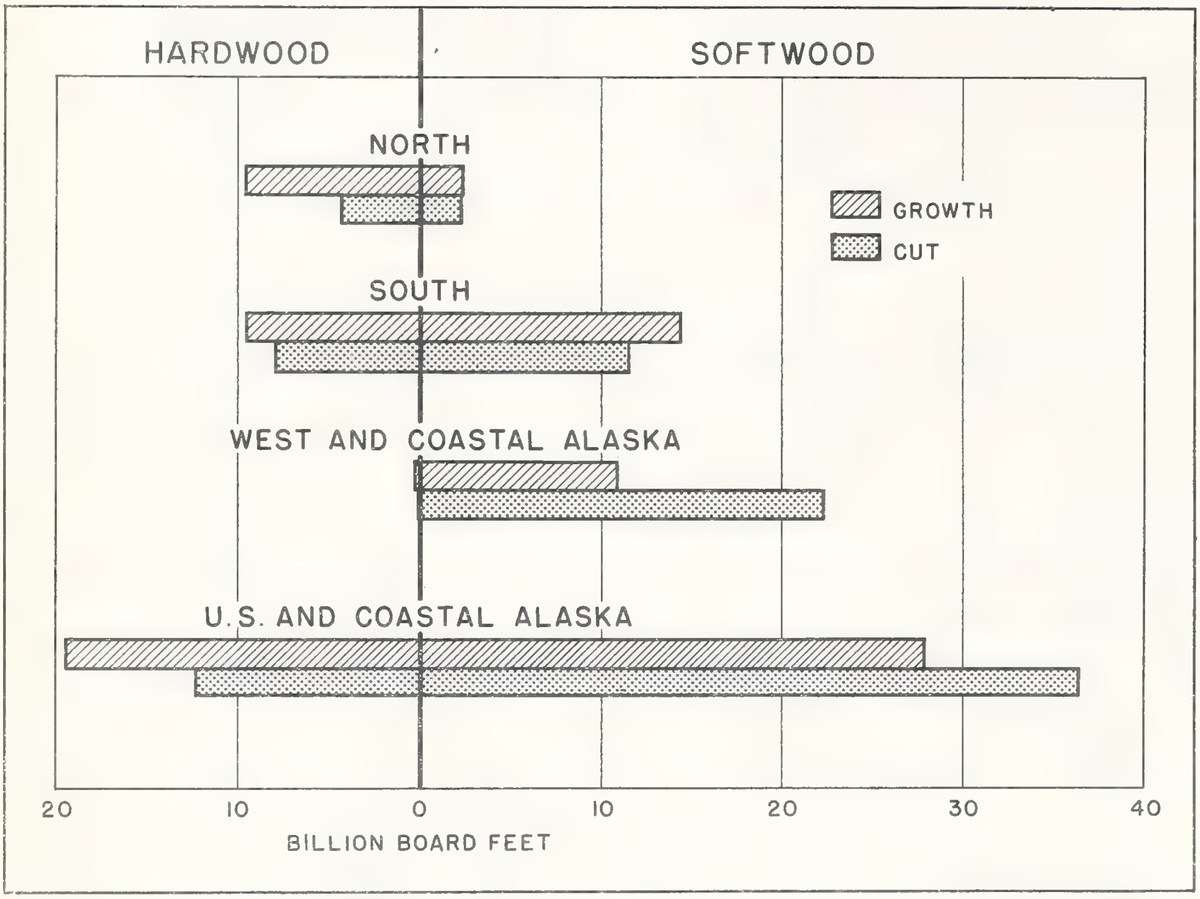


Fig. 8 - Comparison of net annual sawtimber growth and timber cut, 1952

In contrast, growth in the West, almost entirely softwood, is only 50 percent of cut. However, in the present transition from virgin timber to young timber, annual growth should not be expected to equal cut. Comparison of growth and cut does not provide a helpful criterion of the situation in the West.

The More Desirable Species Generally Have the Less Favorable Growth-Cut Relations

Heavy cutting of the more desirable species and limited markets for the less desirable tend to make the growth-cut relations for the former less favorable than for the latter (figs. 9 and 10).

Among eastern softwoods, for example, sawtimber growth of white, red, and jack pine, including the traditionally most valuable species, remains less than cut; spruce and fir comes next in order with growth not greatly in excess of cut. For the southern yellow pines, the ratio of growth to cut is 1.22. "Other eastern softwoods," including the less valuable hemlock, have the highest ratio of growth to cut.

A similar progression appears among the hardwoods. Yellow poplar, a species of specialized value, is being cut somewhat faster than it is growing. For other soft hardwoods--those which have access to pulpwood markets but are not generally otherwise under pressure--growth is about 1-1/2 times cut. Similar ratios appear for the oaks and beech, yellow birch and sugar maple--groups which include species of mixed value. For other hard hardwoods--a group which includes many relatively undesirable species--sawtimber growth is 2-1/2 times the cut. Such relations point clearly to an increase in the proportion of the less desirable species in our future timber supply.

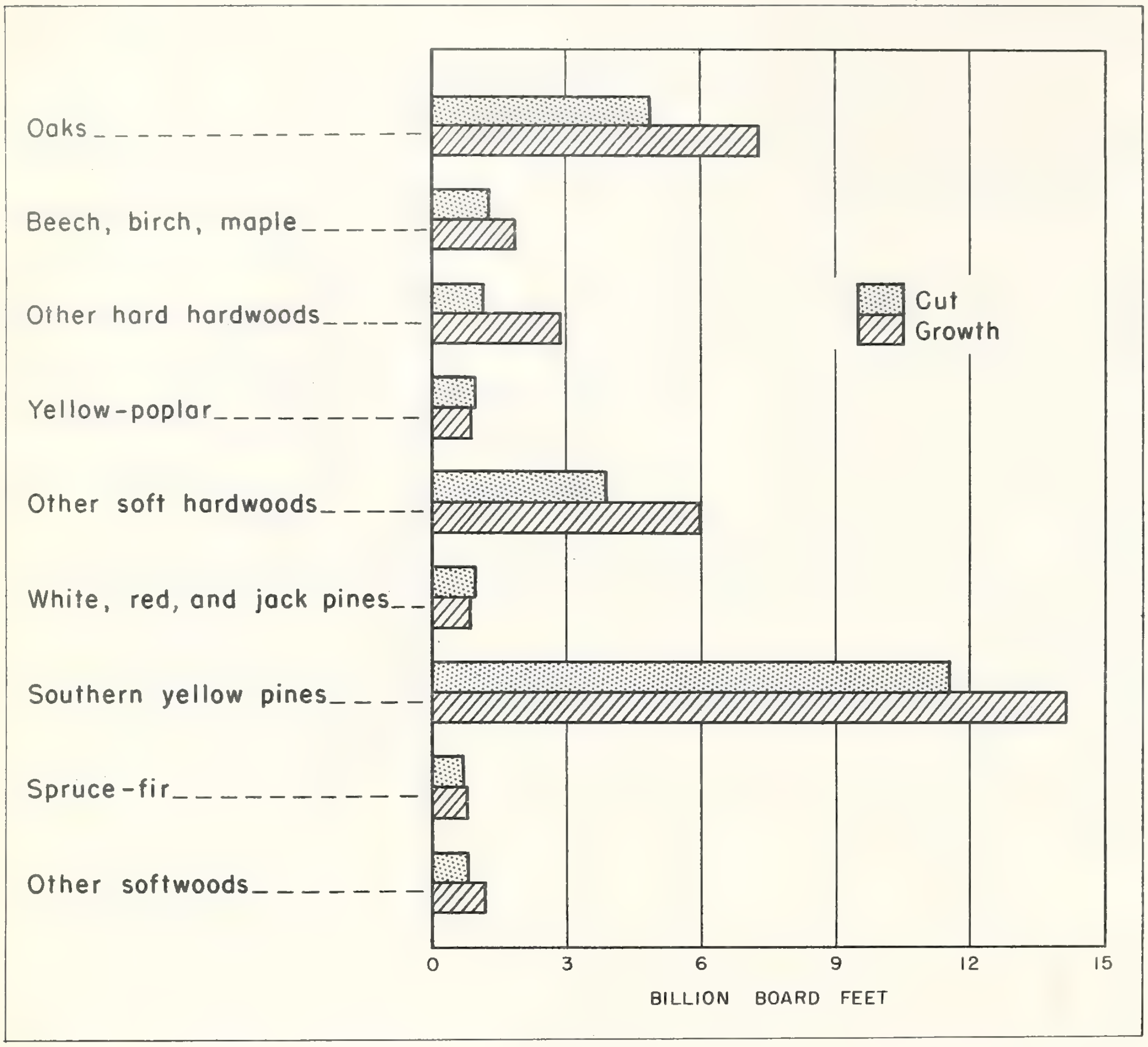


Fig. 9 - Comparison of net annual sawtimber growth, and timber cut by species group, 1952 - Eastern Species

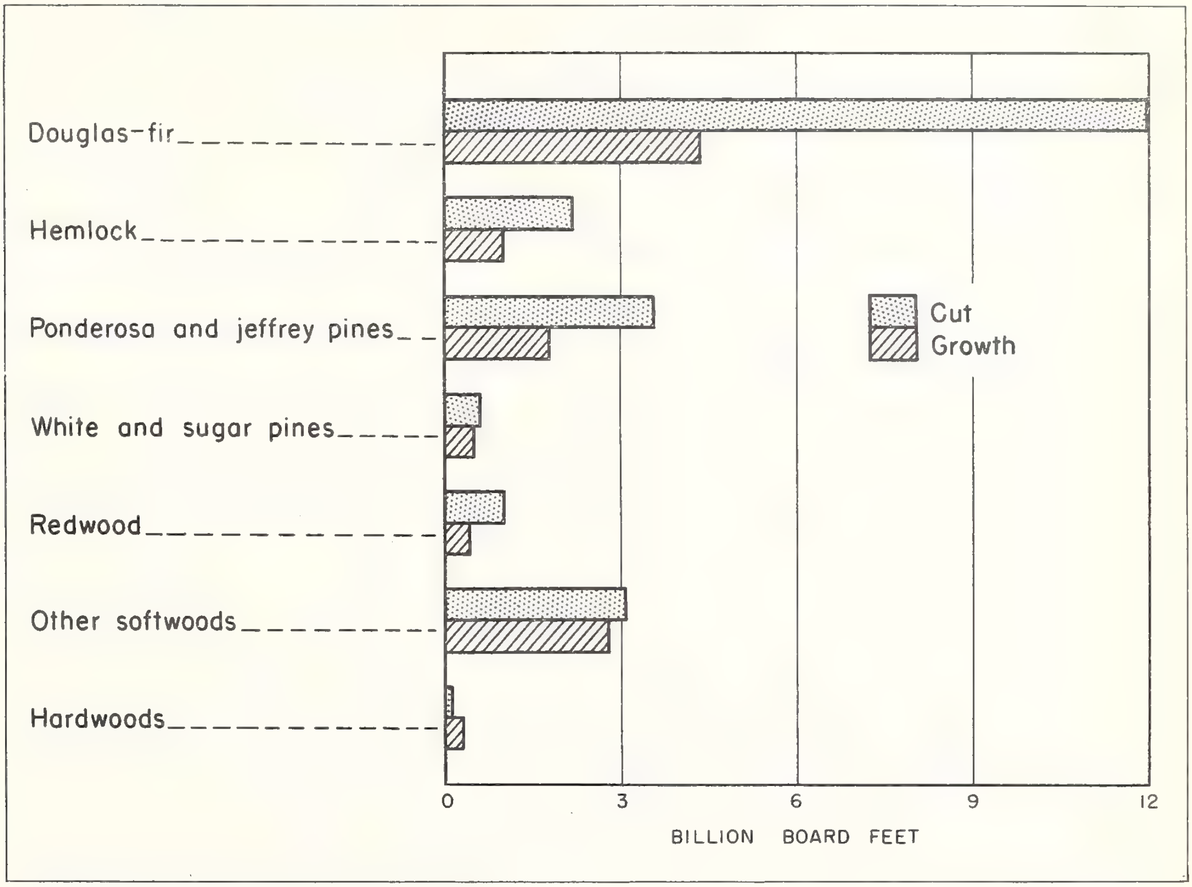


Fig. 10 – Comparison of net annual sawtimber growth, and timber cut by species group, 1952 - Western Species. Growth-cut relations reflect high proportion of old-growth timber which supports a large cut and contributes little to net growth.

Ratio of Growth to Cut, by Species Groups

Species group	Sawtimber	Growing stock
EASTERN		
Spruce and fir	1.11	1.20
White, red, and jack pines	.93	1.05
Southern yellow pines	1.22	1.15
Other eastern softwoods	1.39	1.56
Yellow poplar	.96	1.33
Other "soft" hardwoods	1.55	2.17
Oaks	1.49	1.92
Beech, yellow birch, and sugar maple	1.46	2.21
Other "hard" hardwoods	2.56	3.66
WESTERN		
Douglas-fir	.37	.46
Ponderosa and Jeffrey pines	.51	.79
Western hemlock	.47	.63
White and sugar pine	.88	1.03
Redwood	.40	.47
Other western softwoods	.91	1.56
Western hardwoods	3.30	6.48

In the West—where cutting is largely in virgin timber with little or no net growth—the smallest ratio of sawtimber growth to cut, 37 percent, is that for Douglas-fir, the most heavily cut species. The ratios for redwood, western hemlock, and ponderosa and Jeffrey pines are somewhat higher, but for "other western softwoods," the group which includes the less desirable species, such as white and red fir and lodgepole pine, annual growth is 91 percent of cut. Western white and sugar pines appear as an exception to the progression. For these highly prized species, the ratio is almost as high as for "other western softwoods."

An Excess of Growing-Stock Growth over Cut Is Important for Continued Sawtimber-Balance

In table 12 and the preceding text tabulation, it will be seen that the ratios of growth to cut for growing stock are generally higher than corresponding ratios for sawtimber. This simply means that our growth-cut balances are better when we consider merchantable trees of all sizes than when we consider only the larger and generally higher quality trees.

So long as most of the commercial timber cut is taken from the larger-sized trees whereas annual growth is more uniformly distributed among trees of all size classes, a balance of cubic-foot growth and cut of total growing stock will not give a balance of sawtimber growth and cut. Conversely, with anything like the present pattern of size

classes in timber cut, a balance of sawtimber growth and cut will generally be accompanied by a surplus of growth over cut of total growing stock.

For this reason, growth-cut ratios for sawtimber are more significant than those for growing stock. If sawtimber ratios are favorable, growing-stock ratios are likely to be even more so; but a favorable growing-stock ratio may be misleading if the sawtimber relations are not also considered.

Other Significant Aspects Revealed in Sawtimber Analysis by Regions

New England

In contrast to the overall situation in the East, softwoods are being overcut in New England; sawtimber growth is only about two-thirds of sawtimber cut (table 13). The overcut is most pronounced in white pine, less so for spruce and fir. "Other softwoods," chiefly hemlock, shows the most favorable growth-cut ratio, 96 percent.

Hardwood growth in this region is 2.4 times the sawtimber cut. However, soft hardwoods other than yellow poplar are an exception. Much of the hardwood growth is in timber of small size and poor quality.

Middle Atlantic

In this region also, softwood sawtimber growth falls below the cut (table 13). The overcut, however, is confined to white pine and southern yellow pine. For softwoods other than the pines, growth exceeds cut by a substantial margin. The heaviest overcut is in the southern pine stands of New Jersey. Hardwood growth, much of it inferior, is 2.1 times the sawtimber cut.

In both Middle Atlantic and New England Regions, development of markets for the accumulating hardwood growth presents a major challenge.

Lake States

In contrast to the situation in New England, growth of white, red, and jack pines and of spruce and fir is greatly in excess of sawtimber cut: 2-1/2 times for pine and 5-1/2 times for spruce and fir (table 13). The demand for jack pine--which is now the principal pine marketed in this region--does not appear to be keeping pace with the current wave of young timber reaching sawtimber size.

Perhaps the most surprising feature of the generally favorable hardwood situation is the unfavorable relation between sawtimber growth and cut of beech, yellow birch, and sugar maple in the Lake States Region. The cut of these species in this region is more than double the annual growth. This means rapid depletion of the remaining old-growth hardwood timber in the region. The Lake States also differ from other eastern regions in an overcut of "other softwoods," chiefly hemlock, a species commonly associated with beech, yellow birch, and sugar maple.

Table 13.--Timber cut and net annual growth of live sawtimber, by species group, and by region, 1952 (North)

Species group and item	Total, North	New England	Middle Atlantic	Lake States	Central	Plains
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Softwood:						
White, red, and jack pine:						
Cut	929	618	149	162	(1/)	..
Growth	845	298	124	417	6	..
Southern yellow pine:						
Cut	257	8	178	..	61	10
Growth	317	2	107	..	184	24
Spruce and fir:						
Cut	668	560	64	44	..	..
Growth	741	426	67	248	..	..
Other softwoods:						
Cut	516	195	117	178	24	2
Growth	572	188	172	137	59	2/ 16
Total, softwoods:						
Cut	2,370	1,381	508	384	85	12
Growth	2,475	914	470	802	249	40
Hardwood:						
Yellow-poplar:						
Cut	175	1	77	..	97	..
Growth	323	5	155	..	163	..
Other soft hardwoods:						
Cut	875	86	217	259	283	30
Growth	2,678	70	391	1,239	742	236
Total, soft hardwoods:						
Cut	1,050	87	294	259	380	30
Growth	3,001	75	546	1,239	905	236
Oaks:						
Cut	1,614	41	486	157	899	31
Growth	3,486	125	983	440	1,872	66
Beech, yellow birch, hard maple:						
Cut	1,178	245	408	333	192	(1/)
Growth	1,722	534	733	158	297	..
Other hard hardwoods:						
Cut	494	14	99	107	253	21
Growth	1,390	209	428	54	640	59
Total, hard hardwoods:						
Cut	3,286	300	993	597	1,344	52
Growth	6,598	868	2,144	652	2,809	125
Total, hardwoods:						
Cut	4,336	387	1,287	856	1,724	82
Growth	9,599	943	2,690	1,891	3,714	361
Total, all species:						
Cut	6,706	1,768	1,795	1,240	1,809	94
Growth	12,074	1,857	3,160	2,693	3,963	401

1/ Less than 0.5 million board feet.
2/ Net growth of ponderosa pine. The total net growth of ponderosa and Jeffrey pine in the United States is 1,857 million board feet including 16 million board feet in the Plains Region.

Growth of oaks in the Lake States Region is about three times the sawtimber cut of these species. As in the Northeast, however, much of the oak is of poor quality. Growth of soft hardwoods, chiefly aspen in this region, is almost five times the cut. Markets for aspen still fall far short of the available supply.

Central and Plains Regions

In the Central and Plains Regions, growth, predominantly hardwood, is more than twice the sawtimber cut (table 13). A substantial excess of growth is shown for every species group.

South Atlantic

In the South Atlantic Region, sawtimber growth exceeds cut for all species groups except yellow poplar, which is being overcut about 4 percent (table 14). There is not much excess growth for southern yellow pines (8 percent). The most favorable relation (growth 4.2 times cut) appears in "other hard hardwoods," the group which includes some of the least desirable species.

Southeast

In the Southeast, not only yellow poplar but also other soft hardwoods and the oaks run counter to the generally favorable growth-cut situation for the South (table 14). Yellow poplar is being heavily overcut, the other two groups less so. As in the South Atlantic Region, the less desirable hard hardwoods have the most favorable ratio.

The excess of sawtimber growth overcut of southern yellow pine is somewhat greater than in the South Atlantic Region but still not large (15 percent).

West Gulf

The West Gulf Region shows a greater surplus of southern yellow pine growth (54 percent) than any other region (table 14). In this region, there is a general surplus of hardwood growth, with the hard hardwoods again showing the highest ratio.

Pacific Northwest

In the Pacific Northwest, the growth of all softwoods has reached about 40 percent of sawtimber cut (table 15). However, whereas growth of Douglas-fir and ponderosa pine is only about one-third of the cut of these species, growth of "other softwoods" does not fall far below the cut of that group. In this and other western regions, growth-cut ratios mean little because of the large volume of old-growth timber which supports a large cut but contributes little to annual growth.

California

In California, the relations are similar to those in the Pacific Northwest, except that for "other softwoods" (white and red fir, incense

Table 14.--Timber cut and net annual growth of live sawtimber, by species group, and by region, 1952 (South)

Species group and item	Total, South	South Atlantic	Southeast	West Gulf
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Softwood:				
White, red, and jack pine:				
Cut	43	30	13	..
Growth	61	41	20	..
Southern yellow pine:				
Cut	11,353	3,228	5,546	2,579
Growth	13,838	3,493	6,378	3,967
Spruce and fir:				
Cut	(1/)	(1/)	..	..
Growth	1	1	..	..
Other softwoods:				
Cut	325	102	165	58
Growth	595	135	281	179
Total, softwoods:				
Cut	11,721	3,360	5,724	2,637
Growth	14,495	3,670	6,679	4,146
Hardwood:				
Yellow-poplar:				
Cut	813	400	409	4
Growth	625	383	239	3
Other soft hardwoods:				
Cut	3,017	662	1,504	851
Growth	3,363	1,018	1,254	1,091
Total, soft hardwoods:				
Cut	3,830	1,062	1,913	855
Growth	3,988	1,401	1,493	1,094
Oaks:				
Cut	3,280	804	1,405	1,071
Growth	3,830	1,334	1,257	1,239
Beech, yellow birch, and maple:				
Cut	112	23	71	18
Growth	155	38	73	44
Other hard hardwoods:				
Cut	656	103	298	255
Growth	1,549	437	533	579
Total, hard hardwoods:				
Cut	4,048	930	1,774	1,344
Growth	5,534	1,809	1,863	1,862
Total, hardwoods:				
Cut	7,878	1,992	3,687	2,199
Growth	9,522	3,210	3,356	2,956
Total, all species:				
Cut	19,599	5,352	9,411	4,836
Growth	24,017	6,880	10,035	7,102

1/ Less than 0.5 million board feet.

Table 15.--Timber cut and net annual growth of live sawtimber by species group, and by region, 1952
(West and Coastal Alaska) 1/

Species group and item	Total, West and Coastal Alaska	Pacific Northwest: Total	Pacific Northwest: Douglas-fir subregion	Pacific Northwest: Pine subregion	California	Northern Rocky Mountain	Southern Rocky Mountain	Coastal Alaska
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Softwood:								
Douglas-fir:								
Cut	11,962	9,193	8,827	366	2,333	393	43	..
Growth	4,431	3,193	3,022	171	787	388	63	..
Ponderosa and Jeffrey pine:								
Cut	3,603	1,497	149	1,348	1,274	475	357	..
Growth	2/ 1,841	496	57	439	553	368	424	..
Western hemlock:								
Cut	2,225	2,193	2,172	21	2	9	..	21
Growth	1,038	931	911	20	9	27	..	71
White and sugar pine:								
Cut	609	63	23	40	324	222	..	..
Growth	535	119	98	21	207	209	..	..
Redwood:								
Cut	987	..	..	..	987	..	..	..
Growth	396	..	..	..	396	..	..	..
Other softwoods:								
Cut	3,069	1,273	998	275	784	798	149	65
Growth	2,800	1,095	922	173	943	516	190	56
Total, softwoods:								
Cut	22,455	14,219	12,169	2,050	5,704	1,897	549	86
Growth	11,041	5,834	5,010	824	2,895	1,508	677	127
Hardwood:								
Cut	80	52	52	(3/)	20	2	6	..
Growth	265	143	139	4	44	26	51	1
Total, all species:								
Cut	22,535	14,271	12,221	2,050	5,724	1,899	555	86
Growth	11,306	5,977	5,149	828	2,939	1,534	728	128

1/ Growth-cut relations for western species mean little because of the old-growth timber which provides a large base but contributes little to net growth.

2/ Excludes 16 million board feet of net growth of ponderosa pine in the Plains Region. The total net growth of ponderosa and Jeffrey pine in the United States is 1,857 million board feet.

3/ Less than 0.5 million board feet.

cedar, lodgepole pine, etc.) sawtimber growth exceeds cut 20 percent (table 15). This group includes the less desirable species.

Northern Rocky Mountains

Softwood growth in the Northern Rocky Mountain Region is 80 percent of the sawtimber cut (table 15). In contrast to the usual situation, the relationship is more favorable for Douglas-fir, white pine, and ponderosa pine than for "other softwoods."

Southern Rocky Mountains

In contrast to other western regions, sawtimber growth in the Southern Rocky Mountain Region exceeds cut in all species groups (table 15). This reflects the generally scattered nature of the forests and limited industrial development of the region.

Coastal Alaska

As in the Southern Rocky Mountain Region, growth, although confined largely to the limited areas of second-growth timber, is somewhat greater than the cut in 1952. This situation will doubtless be reversed now that the pulp industry has become established in Alaska, and will continue until sufficient cutover area has restocked and reached sawtimber size to balance the cut of mature old-growth. Coastal forests are just entering a period of conversion from a virgin to a managed stand.

The Relation Between Growth and Cut Is Generally More Favorable Than in 1944

Because of factors previously cited (see page 10), direct comparisons of net growth-cut relations in 1952 with the gross growth-drain relations of 1944 and previous years are of little value. However, adjustment of 1944 data to 1952 standards makes a comparison of 1944 and 1952 relations possible (table 16).

The overall ratio of annual sawtimber growth to timber cut rose from .88 in 1944 to .97 in 1952. This more favorable relation in 1952 is due primarily to the increased growth and decreased cut of hardwoods. The ratio for softwood sawtimber, in fact, changed very little with a slight increase in both growth and cut.

The more favorable relation in 1952 also reflects different trends in East and West (table 17). In the West, the ratio of growth to cut is lower than it was in 1944. The drop was greatest in California and the North Rocky Mountain Regions. In California, this drop was due to the great increase in cut between 1944 and 1952 without material change in annual growth. In the Northern Rocky Mountain Region, the drop was related primarily to the abnormally low growth for 1952 resulting from the barkbeetle outbreak then in progress.

In the East, the relation of growth to cut improved for softwoods as well as hardwoods as a result of increases in growth and reductions in

Table 16.--Net annual growth and timber cut--sawtimber and growing stock, by softwoods and hardwoods, 1944 and 1952
(Continental United States)

Species group	Sawtimber				Growing stock			
	1944 1/		1952		1944 1/		1952	
	Billion bd. ft.	Ratio of growth to cut	Billion bd. ft.	Ratio of growth to cut	Billion cu. ft.	Ratio of growth to cut	Billion cu. ft.	Ratio of growth to cut
All species:								
Net annual growth	43.4	.88	47.3	.97	12.5	1.09	14.2	1.33
Timber cut	49.7		48.8		11.5		10.7	
Softwoods:								
Net annual growth	26.5	.75	27.9	.76	6.5	.88	7.0	.93
Timber cut	35.6		36.5		7.3		7.5	
Hardwoods:								
Net annual growth	16.9	1.19	19.4	1.58	6.0	1.43	7.2	2.25
Timber cut	14.1		12.3		4.2		3.2	

1/ Adjusted as noted on page 10 to make 1944 Reappraisal figures comparable to those of 1952.

Table 17.--Ratio of net annual growth to timber cut--sawtimber and growing stock, by section and region, 1944 and 1952 (Continental United States)

Section and region	Sawtimber				Growing stock			
	Softwood		Hardwood		Softwood		Hardwood	
	1944	1952	1944	1952	1944	1952	1944	1952
North	0.86	1.04	1.47	2.23	.87	1.17	1.53	3.09
New England	.78	.66	1.38	2.43	.92	.81	1.59	4.22
Middle Atlantic	.83	.92	1.38	2.09	.84	1.21	1.68	3.53
Lake States	.83	2.09	1.25	2.21	.83	1.69	2.07	2.47
Central	1.88	2.93	1.65	2.15	.89	2.71	1.16	2.79
Plains	4.44	3.33	2.17	4.46	.87	2.25	1.25	4.46
South	.91	1.24	.99	1.20	.94	1.17	1.30	1.62
South Atlantic	.90	1.09	1.64	1.61	.95	1.06	1.96	1.74
Southeast	.86	1.17	.81	.91	.91	1.16	1.21	1.45
West Gulf	1.01	1.57	.90	1.34	.99	1.35	1.07	1.77
West	.60	.49	4.31	3.30	.82	.70	10.91	6.48
Pacific Northwest	.41	.41	..	..	.51	.54	..	..
Douglas-fir subregion	..	.41	..	..	..	.47	..	..
Pine subregion	..	.40	..	..	..	.92	..	..
California	1.06	.51	..	..	1.29	.59	..	..
Northern Rocky Mtn.	1.31	.79	..	..	2.46	1.80	..	..
Southern Rocky Mtn.	1.47	1.23	..	..	2.12	1.96	..	..
United States	.75	.76	1.19	1.58	.88	.93	1.43	2.21

cut. Exceptions may be noted for New England softwoods and South Atlantic hardwoods. New England softwoods had the least favorable ratio in 1944. Continued depletion of sawtimber growing stock has caused annual growth to decline while cut remained almost unchanged. For South Atlantic hardwoods, an exceptional increase in cut more than compensated for the substantial increase in growth between 1944 and 1952.

These comparisons emphasize three points which have previously been brought out: (1) overall improvement is due almost entirely to hardwoods, (2) the West is under increasing pressure to supply the country's needs, and (3) optimism with respect to the favorable trend for softwoods in the East must be tempered by realization that the improvement reflects in part a decline in timber cut.

LOGGING AND PLANT RESIDUES

Finding use for wood residues which are inevitable in logging and manufacture is one of the most formidable problems in the utilization field. Good progress has been made over the years in reducing the amount of residues left in the woods and in using residues developed at sawmills, veneer and plywood plants, pulp mills and other primary forest products establishments. Yet there is still a great quantity of unused residues and much that is now used for fuel might be used for a better purpose. These unused residues pose many challenging problems.

Difficulties in the utilization of residues are largely associated with their location and availability, inadequate handling facilities, and lack of markets. The following analysis focuses attention on these problems by presenting information on quantity, kind, source, and location of residues and present usage of them.

LOGGING RESIDUES

Each year the inventory of standing timber is reduced a certain amount as a result of cutting for timber products. Most of this reduction is the amount purposely cut for timber products. But some of it consists of trees knocked down or otherwise killed in the process of logging. Part of the inventory volume which is cut or killed is removed from the woods in the form of logs, bolts or other round products. Part of that which is cut or killed, however, is left unused in the woods. This is the material designated as "logging residues". Thus material that is unused and only that portion which is derived from growing stock inventory is classed as residues.

Cutting on a given area may be done for a single product like sawlongs or for a number of products like sawlogs, veneer logs and bolts and pulpwood all at the same time or at different times, and by the same operator or different operators. In logging of this sort certain parts of the felled trees may be utilized for sawlogs, and other parts may be selected for veneer and pulpwood. Only the parts finally unused are classed as residues. Logging residues may include, for example, logs missed in yarding, left at landings, used for culverts or other purposes, pieces resulting from breakage, unutilized portions of trees cut, whether in the boles or tops down to 4 inches in diameter, leftovers in making hewn ties and split products, and growing-stock trees knocked down or otherwise killed during logging and left in the woods.

In addition to the residues from growing stock, there is a large but undetermined volume of other material left on the ground following logging such as sound cull trees, sound portions of rotten culls, previously dead trees, tops less than 4 inches in diameter and limbs. Thus, while this study deals only with logging residues from growing stock any proposal for possible uses of such residues would apply in certain respects to all classes of material that may be available.

Quantity, Source, and Location of Logging Residues

In 1952, about 1.4 billion cubic feet of logging residues resulted from cutting for timber products in the United States and Coastal Alaska (table 7, page 21). Comparatively speaking, this is the equivalent of about 17 million cords or 70 percent of the total pulpwood output in 1952. Seventy-five percent was attributable to sawlog operations, 7 percent to veneer, and the remaining 18 percent to all other logging and woods operations.

On the average, about 13 percent of the growing stock cut or killed in logging is left in the woods unused:

Product	Residues as percent of timber cut
Hewn ties	38
Cooperage logs and bolts	31
Veneer logs and bolts	20
Sawlogs	15
Poles	14
Piling	13
Round mine timbers	6
Pulpwood	4
Fuelwood	4
Other	20
Average all products	13

The production of hewn ties is traditionally the most wasteful of all industries. Residues in relation to timber cut are also high (31 percent) in the production of cooperage logs and bolts chiefly because only the best quality logs are selected and because good cooperage timber is scattered. Thus there is little opportunity for salvage of leftovers for other products. Sawlog and veneer operations likewise leave comparatively large volumes of residues in the woods--15 and 20 percent respectively of the amount of timber cut for these products. Due to the nature of such products as pulpwood, fuelwood, mine timbers and posts, residue volumes are naturally small compared to volume cut.

Although more than half of the total volume of residues incident to logging occurs in the South, the proportion relative to timber cut is not much more than in other sections of the country.

Section	Percentage of total logging residues	Residues as percent of timber cut
North	16	11
South	52	14
West and Coastal Alaska	32	12

Utilization appears to be best in New England where residues constitute only 9 percent of timber cut (table 8, page 24). It is apparently poorest in California in that residues comprise 18 percent of the volume cut or the highest of any region. This is possibly due largely to difficulties including high percentage of breakage associated with logging the large old-growth redwood and Douglas-fir in the northwestern part of the State. Also, opportunities for integrated logging and relogging are not as prevalent here as in the Pacific Northwest because the State lacks pulp mills or other industries which could utilize leftovers from sawlog and veneer operations. Residues in relation to timber cut are also high (15 percent).

Whereas logging residues are widely dispersed at thousands of small logging sites throughout the North and South, large concentrations occur at relatively few sites in the West. About 80 percent of the logging residues in this section are, in fact, concentrated in the Douglas-fir region and California.

Woods Utilization Improved Since 1944

Estimates of drain due to cutting for commodities in 1944 included the limbwood volume in hardwoods which was excluded from the estimates of timber cut in the present study. For this reason it is necessary to deduct the volume of hardwood limbs from the 1944 drain figures to make valid comparisons with timber cut in 1952. On this basis it appears that logging residues in the North represented the same proportion of commodity drain in 1944 as of timber cut in 1952--11 percent. Similarly logging residues in the South were 16 percent of commodity drain in 1944 as compared to 14 percent of timber cut in 1952.

While it is reasonable to suppose that there has been some improvement in utilization in the North since 1944, no radical changes are known to have occurred. The same is true for the South although in this section increased demands for pulp, and improvements in logging equipment and methods probably advanced the limits of utilization in this period more than in the North. The change towards closer utilization in the woods is, however, more pronounced in the West. Here, due to strong demands for lumber, pulp, veneer and other products, such practices as relogging and integration of logging operations, aided by new and better equipment, have greatly broadened the opportunities for more complete utilization of the timber that is cut.

The 1952 estimate for the West indicates that logging residues amounted to only about 12 percent of the timber cut. The 1944 Reappraisal showed nearly three times this amount or 34 percent. The 1944 figures, however, included most if not all of the sound material left over from logging without full allowance for (1) cull and breakage deductions normally accounted for in estimating timber volume or (2) material that would not otherwise qualify as growing stock in inventory determinations. If, as a result of these qualifications, logging residues in relation to the cut of growing stock were reduced as much as 15 percent in 1944, the change by 1952 would still signify remarkable improvement.

In contrast to logging residues, plant residues include all residue material, both coarse and fine, originating in the manufacture of primary forest products, whether used or not, and regardless of whether the logs and bolts were from growing stock or other sources, such as cull and dead trees. Coarse residues consist of slabs, edgings, trimmings, miscuts, cull pieces, veneer cores and other material suitable for remanufacture or chipping. Fines, on the other hand, are residues generally too small for chipping, like sawdust, shavings, wood substance lost in barking, chipper rejects at pulp mills, and veneer clippings.

The character, quantity, or quality of these residues may vary broadly from industry to industry and place to place, as may the opportunity to use them. Considerable quantities of all kinds are used as fuel. Lesser amounts are salvaged for pulp, hardboard, or other fiber products, and for a variety of other purposes including agriculture.

Plant residues represent a major source of wood and although about three-fifths of the volume are being used for one purpose or another, there are opportunities for using much that remains and for the possible use at some higher economic level of residues now being burned as fuel.

Quantity, Source, and Location of Plant Residues

Estimates of plant residues were developed for all plants engaged in the primary manufacture of logs and bolts in the United States and Coastal Alaska including lumber mills and integrated planing mills, veneer and plywood plants, pulp mills[7/], cooperage plants, small dimension and turnery plants, shingle mills, chemical and excelsior plants, and other similar establishments. In the aggregate, plant residues totaled 3.4 million cubic feet in 1952 (table 18). This volume which was divided about evenly between coarse and fine, represents about 40 percent of all raw materials entering the plants as logs and bolts. An indication of what these residues represent as a source of wood is shown by the fact that coarse residues alone are equivalent in volume to entire cut of growing stock for pulpwood in the United States in 1952.

The great bulk of plant residues is attributable to lumber manufacture. In 1952, about 86 percent of the total volume was found in this industry (table 18 and fig. 11). This is not at all surprising since sawmills consume nearly three-quarters of all logs and bolts used in primary manufacture and nearly half the sawlog volume ends up as residues. Much the same situation exists in all regions since the quantity of logs used for lumber in the different regions far exceeds the volume used by other industries. And it is largely because of this that plant residues are

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7/ Plant residues at pulp mills relate only to wood losses in storage and in preparing the wood for pulping. Additional losses of wood substance incurred in the various pulping processes are excluded.

Table 18.--Plant residues, by kind of material, and by industry source, 1952 (United States and Coastal Alaska)

Industry	Total		Coarse	Fine
	Million cu. ft.	Percent	Million cu. ft.	Million cu. ft.
Lumber 1/	2,950	86	1,466	1,484
Veneer	205	6	67	138
Pulp	170	5	82	88
Cooperage	40	2	23	17
Other 2/	49	1	23	26
Total	3,414	100	1,661	1,753

1/ Includes planing mills integrated with sawmills.
2/ Includes small dimension and turnery plants, shingle mills, chemical and excelsior plants, and similar establishments utilizing roundwood.

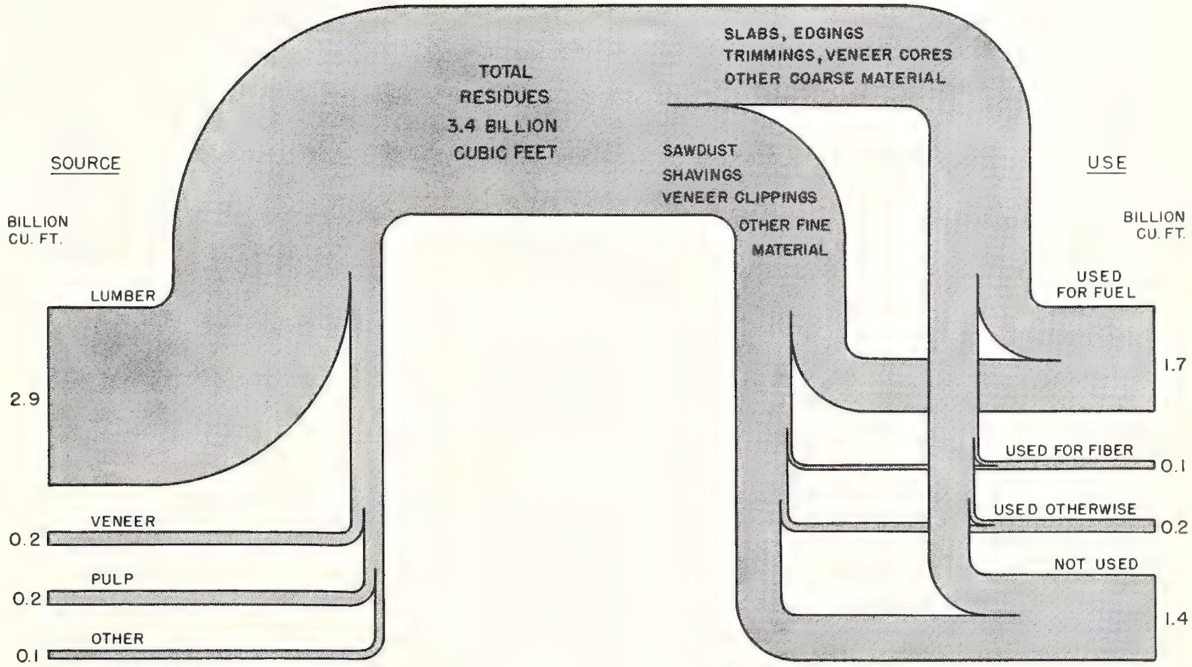


Fig. 11 - Source and use of plant residues, 1952

found to be distributed geographically in about the same proportion as sawtimber cut. Thus 43 percent of all plant residues were located in the West and Coastal Alaska, 43 percent in the South and 14 percent in the North (table 19).

Plant Residues in Relation to Input Are Greatest in Cooperage Manufacture; Least in Preparing Wood for Pulping

Although lumber manufacture is responsible for most of the plant residues volume, the residue volume percent of roundwood entering the plant is not as high as for some other products (table 20). For example, residues in the manufacture of cooperage, because of more exacting quality specifications, are generally greater in relation to the volume of logs and bolts processed than for either lumber or veneer.

At pulp mills, on the other hand, relatively small losses are incurred from the time the pulpwood is received until it is chipped and ready for final processing into pulp. Estimates place these losses at about 7.5 percent of the roundwood volume. Loss of wood substance due to decay in storage, along with a small amount of cull, account for about half of the residue volume. The remainder is made up of rejects in screening chips and wood substance lost in barking.

Log size and size of mill are the principal variables affecting residues in lumber manufacture. Comparatively more residues result in sawing small logs than large, whether in large or small mills, simply because a larger share of the log volume is represented in slabs, edgings and sawdust. Large mills, however, are generally superior to small mills since they are equipped for more efficient sawing and machine operation. Small mills and small timber most often go together. Both are characteristic of the North and South. Large mills, on the other hand, are more characteristic of the West where large timber is still found in abundance.

In addition to log size, log quality and type of product have a significant bearing on the amount of residue in veneer manufacture. Good quality veneer timber has become scarce in all sections of the country. As a consequence, trees that would be regarded at the lower margin for sawlogs are used to an increasing extent for lower grade plywood and containers. Under these conditions more of the log ends up as residues despite measures adapted to save as much as possible in the form of usable veneer by patching and using the poorest material for cores or backing in plywood, or for containers.

Residues in relation to log input for lumber and veneer are highest in the South (table 20). With respect to lumber this may be attributed in part to the preponderance of small softwood logs in the cut, and in part to poor sawing practices prevalent at many of the hundreds of small mills which predominate in the area. In the West, of course, residues represent a smaller share of the log volume because larger timber is being cut. The difference between the North and South is perhaps due to the fact that hardwoods which make up the bulk of the cut in the North are somewhat larger on the average than the general run of softwoods cut in the South.

Table 19.--Plant residues, by kind of material, and by section and region, 1952 (United States and Coastal Alaska)

Section and region	Total: Volume	Total: Percent	Coarse	Fine
	Million cu. ft.		Million cu. ft.	Million cu. ft.
North:				
New England	126	3.7	68	58
Middle Atlantic	143	4.2	79	64
Lake States	110	3.2	61	49
Central	88	2.6	54	34
Plains	4	.1	2	2
Total	471	13.8	264	207
South:				
South Atlantic	504	14.8	241	263
Southeast	663	19.4	299	364
West Gulf	308	9.0	124	184
Total	1,475	43.2	664	811
West:				
Pacific Northwest:				
Douglas-fir subregion	842	24.7	378	464
Pine subregion	130	3.8	58	72
Total	972	28.5	436	536
California	372	10.9	242	130
Northern Rocky Mtn.	81	2.4	31	50
Southern Rocky Mtn.	38	1.1	21	17
Total	1,463	42.9	730	733
Total United States	3,409	99.9	1,658	1,751
Coastal Alaska	5	.1	3	2
United States and Coastal Alaska	3,414	100.0	1,661	1,753

Table 20.--Plant residues as percent of total volume of logs and bolts used in primary manufacture, by type of industry and by section, 1952 (United States and Coastal Alaska)

Section	Lumber[1]	Veneer	Pulp	Cooperage	Other[2]	Total
	Percent	Percent	Percent	Percent	Percent	Percent
North	42.2	43.5	10.1	65.7	27.9	28.5
South	56.1	50.3	6.4	51.9	22.0	39.8
West and Coastal Alaska	43.3	46.0	6.2	10.6	40.5	39.4
United States and Coastal Alaska	47.9	47.2	7.5	54.5	29.4	37.6

1/ Includes planing mills integrated with sawmills.

2/ Includes small dimension and turnery plants, shingle mills, chemical and excelsior plants, and similar establishments utilizing roundwood.

Residue percentages in veneer manufacture are higher in the South than in the West largely because southern veneer plants subsist on much smaller and poorer quality logs than do western plants. Residues from veneer manufacture in the South are also somewhat higher than in the North. This difference appears to be significant but is difficult to rationalize. The higher percentage in the South may however reflect the greater use of relatively poorer quality logs for container veneer which makes up a higher proportion of the veneer output in the South than it does in the North. These logs yield a greater percentage of residues as a rule than do the better quality logs used for commercial and utility grades and face veneers.

Residues percentages are substantially higher in pulp and cooperage manufacture in the North than elsewhere. For pulp, this reflects the longer storage period and consequent greater storage losses and for cooperage it denotes poorer average quality of the material cut.

Use of Plant Residues

In 1952, about three-fifths of the total volume of plant residues were used (fig. 12). About one-half of the used residues were coarse and one-half fine. Residues have long been used for domestic and industrial fuel. In 1952, use as fuel, took 1.7 billion cubic feet or 86 percent of all the residues used (table 21). Put another way, the amount used for fuel is the equivalent of about 31.5 million cords or more than half of the total fuelwood output from all sources. Probably as much as 60 percent of the coarse residues used for fuel are used for domestic purposes whereas most of the fines are burned at industrial plants. Rural areas, such as are common in much of the South, Midwest and Southwest account for a high percentage of the domestic wood used in the form of slabs and similar coarse residues. On the other hand, industrial use is generally associated with large sawmills and veneer plants where large quantities are directly available. These residues frequently present a severe disposal problem, and often provide the most economical fuel where steam and heating requirements are large. This is the situation at many of the large plants in the West.

Although plant residues are used mostly for fuel they have not gone entirely unnoticed for other uses. About 5 percent of the total used volume, for example, was for pulp and 9 percent for a variety of other uses including agriculture (fig. 12). Other than fuel and pulp, coarse residues were used as material for such things as cut-up stock, handles, brush blocks, chemical wood, boxboard, lath, fence pickets, particle boards and many other commodities. Fines, though used mostly for fuel, were also used in various other ways. Some of what was used and not burned consisted of veneer clippings which went into pulp. Considerably more were used for such things as agricultural mulches and soil conditioners, bedding for livestock, poultry litter, insulation, wood flour, linoleum filler, metallurgical use and a wide assortment of other uses.

The use of plant residues for pulp is a fairly recent development. As recently as ten years ago there was little chipping of plant residues for pulp. In 1952, however, the equivalent of about 1.2 million cords, or 30 percent of the pulpwood output in the Pacific Northwest came from

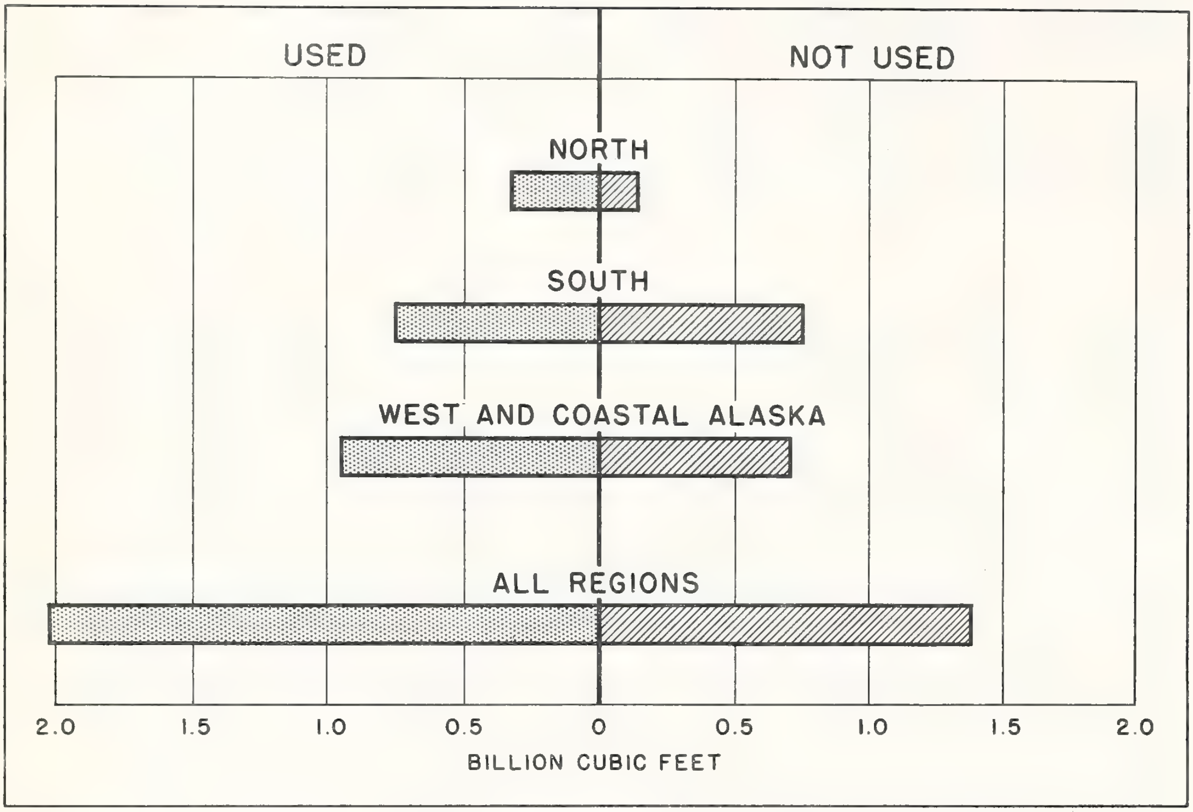


Fig. 12 - Distribution and use of plant residues, 1952

Table 21.--Use of plant residues, by kind of material, and by type of use, 1952 (United States and Coastal Alaska)

Kind of material	Total residues	Residues used for				Residue not used
		Fuel	Fiber	Other[1/]	Total	
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
Coarse	1,661	826	91	69	986	675
Fine	1,753	926	19	101	1,046	707
Total	3,414	1,752	110	170	2,032	1,382

1/ Includes material for cut stock, handles, brush blocks, chemical wood, box board, particle board, floor-cleaning compound, wood flour, insulation, bedding for livestock, poultry litter, soil conditioner, metalurgical use, and other similar purposes.

this source. Residues for pulp had likewise gained in the South and North. Altogether about 6 percent of total pulpwood output in the United States is derived from plant residues. For the most part these residues consisted of slabs, edgings and other coarse sawmill residues and veneer cores. In addition to pulp, practically all the raw material to supply the recent large expansion of the hardboard industry in the West consists of sawmill and plywood residues.

In lumber manufacture, about 55 percent of the residues are used (table 22). The percentage is considerably higher in other industries which have better outlets for residues or can use them to better advantage for fuel. Thus practically all of the veneer and pulp mill residues are used.[8] In cooperage plants and other mills and plants like bolting mills, shingle mills, box plants, excelsior plants, and turnery and dimension plants, about 70 percent of the residues are used.

Because of the greater number of large plants in the West and greater population density and better developed outlets in the North, utilization of residues is comparatively higher in these sections than in the South (table 23). These apparent advantages are the principal reasons why 88 percent of the residues used for pulp are in the West and 44 percent of the residues, other than those used for fuel and pulp, are in the North. Log barkers and chippers now fast coming into use in the South will, however, boost the total of residues used for pulp in that section as time goes on.

Unused Residues Can Help Meet Additional Needs for Timber Products

Greater use of residues could mean large savings of growing stock. Except for fuel, the surface has hardly been scratched and much that is used for fuel could possibly be put to better use. Unused residues, therefore would seem to offer substantial opportunities to meet additional needs for products like pulp, hardboard, small dimension and miscellaneous items without commensurate demands on growing stock.

About 1.4 million cubic feet, or two-fifths of all plant residues, are unused (table 24). This volume is roughly the equivalent of about 12 million cords, or more than the entire volume of fuelwood cut from growing stock in 1952.

About 52 percent of total unused residues are found in the South, 38 percent in the West and 10 percent in the North. Since practically the entire volume results from lumber manufacture, much that is in the South and North is scattered among literally thousands of small mills. In the West, however, residues are found for the most part at the larger mills in the Douglas-fir subregion and in California.

8/ Unlike residues resulting from other types of primary manufacture, residues in preparing wood for pulping have little or no particular use other than fuel.

Table 22.--Plant residues use, by industry source, and by type of use, 1952 (United States and Coastal Alaska)

Industry	Type of use: Fuel	Type of use: Fiber	Type of use: Other 1/	Type of use: Total	Relation of used residues to total residues
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Percent
Lumber 2/	1,397	76	146	1,619	55
Veneer	131	34	15	180	88
Pulp	170	..	..	170	100
Cooperage	25	..	2	27	67
Other 3/	29	(4/)	7	36	73
Total	1,752	110	170	2,032	60

1/ Includes small dimension and turnery plants, shingle mills, chemical and excelsior plants, and similar establishments utilizing roundwood.

2/ Includes planing mills integrated with sawmills.

3/ Includes material for cut stock, handles, brush blocks, chemical wood, box board, particle board, floor-cleaning compound, wood flour, insulation, bedding for livestock, poultry litter, soil conditioner, metalurgical use, and other similar purposes.

4/ Less than 0.5 million cubic feet.

Table 23.--Plant residues use, by section, and by type of use, 1952 (United States and Coastal Alaska)

Section	Type of use: Fuel	Type of use: Fiber	Type of use: Other 1/	Type of use: Total	Relation of used residues to total residues
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Percent
North	252	2	74	328	70
South	702	12	44	758	51
West	795	96	52	943	64
Total, United States	1,749	110	170	2,029	60
Coastal Alaska	3	..	(2/)	3	48
United States and Coastal Alaska	1,752	110	170	2,032	60

1/ Includes material for cut stock, handles, brush blocks, chemical wood, box board, particle board, floor-cleaning compound, wood flour, insulation, bedding for livestock, poultry litter, soil conditioner, metalurgical use, and similar purposes.

2/ Less than 0.5 million cubic feet.

Table 24.--Unused plant residues, by kind of material, and by section and region, 1952 (United States and Coastal Alaska)

Section and region	Coarse	Fine	Total
	Million cu. ft.	Million cu. ft.	Million cu. ft.
North:			
New England	25	18	43
Middle Atlantic	25	27	52
Lake States	5	17	22
Central	13	11	24
Plains	1	1	2
Total	69	74	143
South:			
South Atlantic	109	151	260
Southeast	146	205	351
West Gulf	44	61	105
Total	299	417	716
West:			
Pacific Northwest:			
Douglas-fir subregion	111	115	226
Pine subregion	9	10	19
Total	120	125	245
Calfiornia	162	66	228
Northern Rocky Mtn.	15	15	30
Southern Rocky Mtn.	8	9	17
Total	305	215	520
United States	673	706	1,379
Coastal Alaska	2	1	3
United States and Coastal Alaska	675	707	1,382

Plant residues are in a large measure unavoidable in all types of primary manufacture even with the most modern equipment. Their utilization is complicated by many factors. The lack of markets is a chief hindrance. And even if markets exist, residues must be available cheaply and in sufficient quantity, otherwise potential users may not find it profitable to use them. Most markets are specialized and very often local or regional in character. Thus large concentrations such as are found in the West may offer the best opportunities for economic use.

Despite reasonably good current use of plant residues, there remains the problem of finding profitable ways of using more of them. In some cases this may mean finding new uses for residues, or in some cases it may mean the development of new markets for products that are presently derived from residues.

TRENDS IN UTILIZATION

Failure to get maximum use from the Nation's timber resources has been a matter of growing concern for many years. Fuller use has become increasingly vital in the face of diminishing supplies and expanding requirements for domestic timber. Much has been done about it in the past, and recent developments promise still greater improvement in the future.

Better and more complete utilization in the woods and mill is largely a matter of economics and ingenuity. Improvements in equipment and methods which have taken place over the years in the interest of lowering production costs have in turn contributed to better utilization by making more of the raw material profitable to handle. Advances in utilization have been further stimulated by expanding markets, tightening supplies, higher stumpage and log prices, changes in labor and equipment costs and other economic considerations. New uses for wood and improvement in primary manufacturing processes and the establishment of more pulp mills and other wood-using industries have also influenced the trend by creating markets for material previously left in the woods or unused at the mills.

UTILIZATION IN THE WOODS

Improved Equipment and Logging Methods

Changes in equipment and methods of logging have been responsible for a large part of the progress made in utilizing material in the woods. Fast-working labor-saving equipment for cutting, skidding, loading, transporting and for road building has steadily broadened the limits of profitable logging -- including better use of defective material, salvage logging following the main operation, and greater integration of logging operations wherein parts of trees, suitable for different products, are distributed to the industries that can use them to the best advantage.

Felling and bucking operations have become largely mechanized. Chain saws, now widely used throughout the country for felling and bucking, and power operated circular saws now prominent in southern logging operations have greatly increased output per man at generally lower costs. In 1950 about 70 percent of the felling and bucking operations in the lumber and pulp industries and about 60 percent in the veneer industry were performed with power saws. Lower costs have brought about certain improvements in utilization such as lower stumps, greater use of tops and increased use of sound material in otherwise cull logs.

Skidding is now done largely with tractors, rather than cable yarding engines. Because tractors permit greater flexibility in logging, material considered too costly to operate with various forms of cable yarding can often be handled economically with tractors. And, when handled properly, they are also less damaging to residual timber or down timber. Tractor yarding accounted for 55 percent of the total yarding job in the lumber industry in 1950, 48 percent in the veneer industry, and about one-third in the pulpwood and other industries.

Other woods practices such as yarding full tree lengths to a central point for bucking and package handling of logs and bolts particularly in relogging cutover areas have been stimulated by the development of suitable equipment.

Loading is now done faster, more easily and more cheaply with mobile power equipment thus broadening the range of profitability for material previously passed up. The job of transporting logs and bolts has also undergone development. Motor truck hauling has become so efficient that it is fast replacing the logging railroad even in the West. In 1950, considering both distance and volume transported, it was estimated that about two-thirds of the total job of hauling sawlogs, 70 percent of the total for veneer logs and bolts and 40 percent of the total job of hauling pulpwood was done by truck. Probably most of the logs and bolts that eventually arrived at mill sites by rail or water were transported part way by truck.

The shift from rail to truck has been greatly speeded up by continued improvements in motor trucks, by the construction of public motor highways, and by the bulldozer, the tractor grader, and other equipment for building low-cost woods roads. Truck hauling and low-cost roads have in turn opened up remote timber and the more scattered stands to profitable logging and have increased the opportunities for greater salvage of dead trees and other material formerly considered too costly to handle.

Expanding Markets

Expanding markets for pulp and other forest products have made it possible to take from the woods much previously unsaleable material thus lessening the impact on growing stock. Dead and cull trees and trees from noncommercial forest land form an increasingly large proportion of the cut for lumber, veneer, pulp, fuelwood, posts, mine timbers and various miscellaneous products. And tops of felled trees, broken and cull pieces and other material previously left in the woods are marketable to an increasing extent for such products as pulpwood, fuelwood, posts and mine timbers. Currently about 12 percent of the pulpwood in the South is derived from tops left after logging for other products.

Transition from Large to Small Sawmills

Although small sawmills as a rule are less adequately equipped for efficient sawing than large sawmills, the small portable mill has brought about certain improvements in utilization. Small portable mills, for example, can often operate profitably on smaller and poorer quality timber or on missed logs, chunks and other residues left on logged-over areas. The practice of employing small mills to clean up logged-over areas in parts of the West is growing.

Shortages Force Better Utilization of Veneer Timber

The veneer and plywood industry offers a particularly fine example of technological adjustment to a declining resource. When quality timber was more plentiful only the large clear logs were sought for veneer. But as competition developed for quality timber and demands for veneer and plywood increased, specifications had to be correspondingly lowered. Thirty inches used to be the minimum diameter for softwood veneer logs and these logs had to be clear. Now logs as small as 18-inches in diameter and with many defects are used. Sound sections of cull trees are also salvaged.

Smaller logs also are used for hardwood veneer, often only 12- to 15-inches in diameter, and as small as 9-inches for some products. Slicers are used to an increasing extent as a means of utilizing species, that because of irregular grain, splits, stresses, and brash centers, cannot be handled well on the lathe.

UTILIZATION OF PLANT RESIDUES

Improvement in handling and processing equipment, increasing demands for pulp and other products, the creation of new markets and uses for wood have tended to increase the utilization of plant residues.

During the last few years, pulp mills have made increasing use of the slabs, edgings and trim discarded at sawmills and the hardboard industry, particularly in the West, has based its expansion almost entirely on this kind of material. Only limited amounts of bark can be tolerated, thus there has been increasing use of mechanical and hydraulic barkers to remove the bark from logs as they enter the mills or for later barking of the slabs themselves. While most of the residues used for pulp and hardboard come from the larger mills, good progress is being made in the utilization of slabs and other coarse residues at small centers of concentration through the development of portable chippers and improved equipment for faster and easier handling.

Veneer cores, already bark free, have become especially attractive for pulp and their use for this purpose has grown steadily. A similar use has developed for veneer clippings particularly on the west coast where supplies are plentiful and cheap.

While the growing use of residues for pulp is perhaps the most spectacular, other uses for plant residues have likewise expanded considerably in recent years due to growing markets and scarce timber supply. Greater quantities of sawmill and other coarse plant residues, for example, are being diverted for remanufacture and the development of processes and markets for fine residues like sawdust and shavings has opened up opportunities for better and more complete utilization of these residues.

Not to be overlooked is the progress made in the use of both coarse and fine residues for charcoal and a wide assortment of other derivatives developed in carbonization, extraction, hydrolysis or other chemical utilization processes. There has also been a definite trend

towards integration of industries where the residues of one become the raw material for another. Thus through reduced raw material costs, utilization of residues has become a more profitable undertaking.

THE UTILIZATION OUTLOOK

Full economic use of the entire volume of woods and plant residues may never be possible. Yet in building up the Nation's timber supply to meet the ever increasing demands of the future, advantage must be taken of every possible opportunity to make the timber we have go further. Recent progress is evidence that many of the problems of finding profitable ways of doing this are being overcome. The outlook is for continued improvement.

Some of the improvement is expected to result from closer utilization of growing stock in the woods with a consequent reduction of logging residues, some through reduction in amount of plant residues due to better sawing and other manufacturing practices and more complete utilization of plant residues, and some through greater use of dead and cull trees and trees from noncommercial forest land. Greater integration of the timber products industries, both in the woods and mill is likewise expected to accomplish more complete and advantageous utilization of the timber that is cut or should be cut. And the practice of relogging cutover areas should gain momentum as better and more suitable equipment for handling and transporting the material economically is developed, and as small portable sawmills are employed to a greater extent to process the leftovers on previously logged areas in the West.

Present trends and anticipated progress in utilization indicate an overall reduction of about 4 percent by 1975 in growing stock needed for a given level of output of all products combined. In other words, the total output which required the cutting of 100 cubic feet of growing stock in 1952 will require cutting only 96 cubic feet in 1975. Whereas only an improvement of 2 percent seems to be a reasonable expectation for lumber, about a 14 percent improvement appears in the offing for pulpwood since a correspondingly large proportion is certain to come from plant residues, tops, and dead and cull trees.

This trend in the use of plant residues for pulp very probably denotes the largest gains in utilization that can be foreseen. More practicable log and slab barkers will undoubtedly be developed which will greatly extend the market possibilities for use of coarse sawmill residues for pulp and various types of hardboard. And better and more efficient equipment for handling residues and portable chippers now in the development stage may be expected to substantially increase the market potentials for residues from small and widely scattered concentrations.

In addition to pulp, the use of plant residues in remanufacture, in agriculture, and in chemical utilization is certain to grow in response to continuing strong market demands, and as competition for the available timber becomes more acute. In this connection it seems reasonable that, as markets and prices continue to improve, much of the residue volume that is now used for fuel will be sought for pulp or put to other more advantageous uses.

Continued research to promote better utilization should lead to better forest management. And better forest management, in the final analysis is basic to building up and maintaining the forest resources at a level sufficient to take care of whatever needs we can foresee for timber products.

CONCLUSION

THE SITUATION WITH RESPECT TO TIMBER GROWTH AND UTILIZATION HAS IMPROVED

The situation with respect to growth and utilization of timber in the United States is better than at any previous time. Most encouraging is the fact that net annual growth of sawtimber in 1952 was 9 percent more than in 1944. Sawtimber growth in 1952--47.4 billion board feet--was only 1.4 billion board feet (or 3 percent) less than sawtimber cut.

Sawtimber cut was 2 percent lower in 1952 than in 1944 although the output of lumber, pulpwood, and veneer logs was greater than at any time in 25 years. Some of the increased output of lumber, pulpwood, and veneer logs was offset by a decline in the timber cut for fuelwood, hewed ties, and other products. But timber cut was also held down by better utilization in both woods and mills. Fifteen percent of the total output came from dead and cull trees and other material not in the growing-stock inventory. Half of the fuelwood and 6 percent of the pulpwood output was obtained from plant residues and so did not add to timber cut.

With an increase in annual growth and a decline in timber cut, the relations between growth and cut were more favorable in 1952 than in 1944. However, the improvement was primarily in hardwoods. There was little overall improvement in softwoods. Nevertheless an excess of softwood sawtimber growth over cut in the East is one of the most significant findings of this chapter.

Growth of growing stock in 1952 was 33 percent in excess of cut. This is a natural accompaniment of the near-balance for sawtimber with the present pattern of products cut. So long as most of the cut is taken from trees 12 inches or more in diameter, whereas annual growth is spread rather uniformly among all size classes, an excess of growing-stock growth will appear when sawtimber growth and cut are in balance.

However, a balance of growth and cut at about existing levels is of relatively minor significance, because future needs are expected to be substantially greater than present cut. Looking to the future, growth needs to be increased much more to keep up with the demands of an expanding economy. A substantial and sustained surplus of growth over cut must be developed, especially in the East, if growing stock is to be built up enough to produce the additional growth when it is needed.

DISTRIBUTION OF GROWTH AND CUT ARE NOT WELL BALANCED

While evidence such as has been cited in the preceding paragraphs makes it clear that the overall situation as to growth and utilization of timber has improved, it is important to recognize certain qualifications.

Proportion of Hardwood and of Inferior Species Increasing

Most important perhaps is the evidence that composition and quality of annual growth and timber cut are not well balanced. Only 25 percent of the cut is from hardwoods, but these species make up 41 percent of the growth. Such an imbalance will almost certainly mean an increasing proportion of hardwoods in our future timber inventory. Accumulation of hardwoods while softwoods have difficulty holding their own looms as a great challenge to the technology of wood utilization.

The problem of composition and quality of annual growth and of timber used reaches beyond the general distinction between hardwoods and softwoods. The more favored species of both hardwoods and softwoods are more heavily cut than the less favored species. In the East, for example, such species as white, red, and jack pine are more heavily cut than the less desirable hemlock and larch, and yellow poplar is cut more heavily than other soft hardwoods like sweetgum, tupelo, and blackgum. Hence the latter are increasing at the expense of the former.

Theoretically, careful forest management should lead to an improvement in forest composition: good management attempts to reproduce and perpetuate desirable species while removing inferior species and holding them in check in new growth. But management is so limited by economic and technological considerations that it is not always possible to reverse or even greatly modify the adverse trends which have been described.

Increasing Dependence on the West

A second factor to consider is the Nation's increasing dependence on the West for its sawtimber cut. This seems logical as well as inevitable in the current situation but future output will need to be more nearly proportional to the area of commercial forest land or to its growth capacity.

The South still leads in cut of growing stock with 47 percent of the total cubic-foot cut. But the West now provides 46 percent of the sawtimber cut while the South contributes only 40 percent. The West had only 34 percent of sawtimber cut in 1936 and 38 percent in 1944. Where will the Nation get its sawtimber when the old-growth in the West is cut, unless the East can meet the need?

While the cut was increasing in the West in response to a strong demand, the cut of softwood sawtimber declined between 1944 and 1952 in both the North and South. This decline is especially significant in the South because the greatly increased pulp-mill capacity brought into operation during the period in that region might be expected to increase the cut. Actually, because of a shortage of softwoods of sawtimber size, the increased cut of pulpwood was obtained largely from poletimber and tops of trees cut for sawlogs.

There are large opportunities for fuller and better use of the timber we grow. Perhaps the most obvious is the reduction of losses from fire, insects, disease, and other causes. These losses amounted to 12.5 billion board feet in 1952. They are deducted from gross growth in the computation of net annual growth. Thus, whatever reduction of mortality can be accomplished by more complete protection and by better forest management adds directly to the net annual growth available for use.

Other opportunities can be visualized by study of the elements of input and output in the timber economy (fig. 13). The timber input totaled 13.6 billion cubic feet. In this total were imports, chiefly pulp and paper products and softwood lumber, with roundwood equivalent of 1.1 billion cubic feet. The chart indicates that only 52 percent of the total timber input finds its way into products other than fuelwood. Another 28 percent is used for fuel, much of it in the wood-conversion plants themselves. Twenty percent of the input, about equally divided between logging and mill residues, is not used at all:

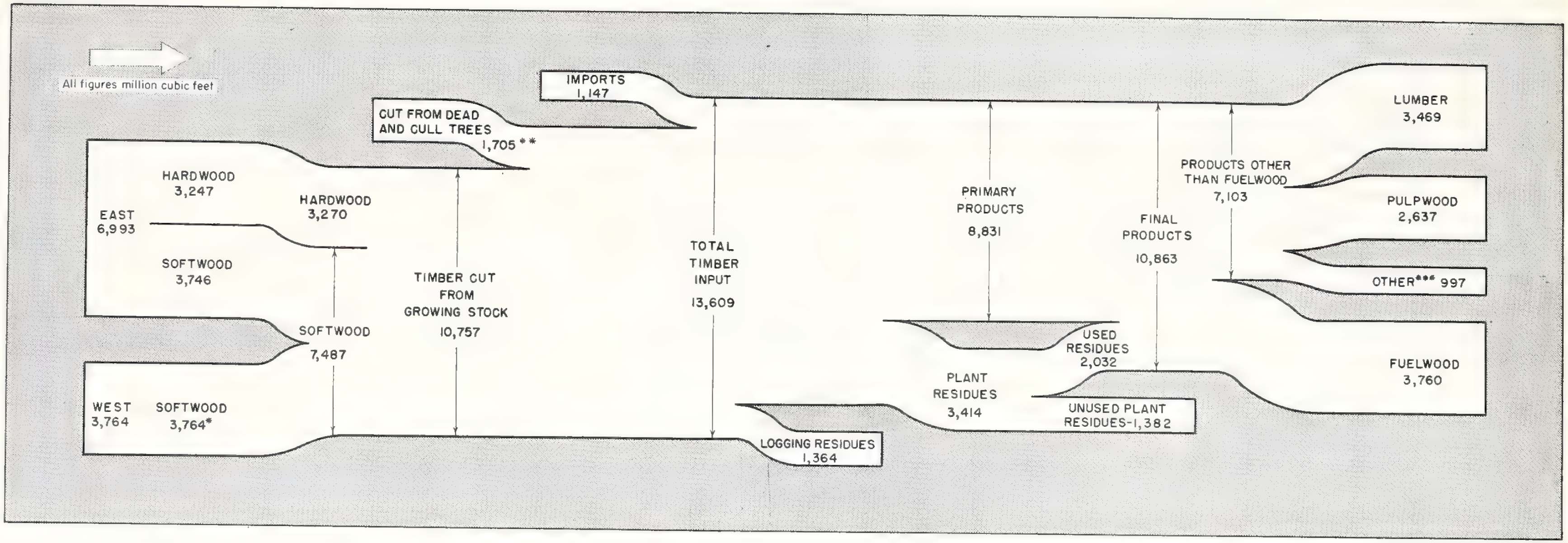
Source and Disposition of Timber Input

Source	Percent of Input	Disposition	Percent of Input
Timber cut from growing stock		Lumber	25.5
Softwood	55.0	Pulpwood	19.4
Hardwood	24.0	Other	7.3
Total	79.0	Total	52.2
Cut from dead and cull trees 1/	12.5	Fuelwood	27.6
		Unused	
Import equivalent	8.5	Logging residues	10.0
		Plant residues	10.2
Total	100.0	Total	20.2
		Total	100.0

1/ Includes commercial species under 5.0 inches d.b.h., tops under 4.0 inches, and trees from noncommercial and nonforest land.

There is a large opportunity in greater use of salvable dead and cull trees, the volume of which was estimated as 65 billion cubic feet in 1952. In that year, only 1.7 billion board feet of such timber was cut for use. Use of such trees reduces the drain upon growing stock and so tends to improve the relation of annual growth to timber cut.

Other opportunities lie in more complete utilization of the timber cut. Logging residues amounted to 1.4 billion cubic feet, or 13 percent of the timber cut from growing stock in 1952. This is



* Includes 23 million cubic feet of hardwoods.

** In addition to cull and dead trees, includes trees of commercial species less than 5.0 inches in diameter and tops less than 4.0 inches in diameter, and trees from noncommercial forest land.

*** Includes a small quantity of plant residues used in agriculture.

Fig. 13 - Input and output in the timber economy, United States, 1952
(Million cubic feet)

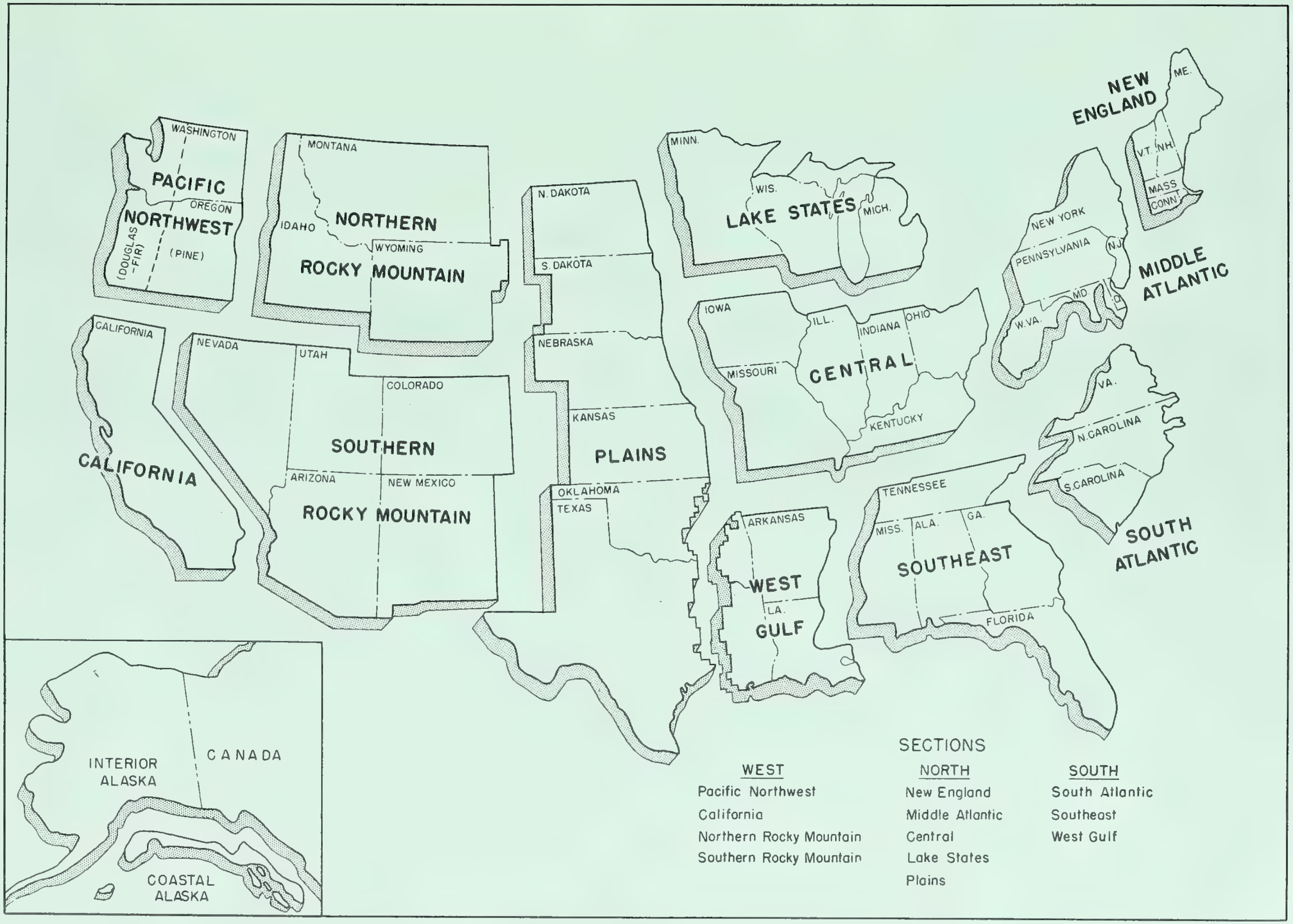
equivalent to 70 percent of the country's pulpwood output. Much of it is suitable for pulpwood and will be so used if technology can work out the economics of its collection and delivery to the pulp mills.

Plant residues, chiefly at sawmills, offer additional opportunities. These residues amounted to 3.4 billion cubic feet in 1952--40 percent of the volume of all logs and bolts processed and 25 percent of the total timber input. Although 60 percent of the plant residues are now used, only 14 percent is for purposes other than fuel. Unused plant residues comprise a greater volume than all the timber cut for fuelwood.

Better markets, introduction of new timber products, and development of new equipment for harvesting and processing, all make possible fuller and better timber use. Progress in each of these fields will help in meeting future timber needs.

What has been said about increasing use of woods and plant residues has significance chiefly with respect to the softwoods which present the most critical supply problem. Such considerations are of secondary importance for hardwoods. With hardwoods the problem is not primarily supply, but rather demand.

The challenge of underutilization of hardwoods is perhaps the major issue brought out by the analyses of growth, cut, and use. Hardwood volume is accumulating and annual growth of hardwoods is increasing. Yet hardwood cut has fallen off since the end of World War II. Hardwood forest types comprise more than half the total commercial forest area. They are expanding at the expense of softwood types. The excess of annual growth over cut for hardwoods is of little consequence when there is so little evidence that a more abundant supply will bring forth commensurate increase in demand. Fuller utilization of hardwoods should help to take the pressure off the softwoods.



Regions and Sections used in the Timber Resource Review

TIMBER RESOURCE REVIEW

CHAPTER IV
FACTORS AFFECTING FUTURE SUPPLY AND QUALITY OF DOMESTIC TIMBER

A. FOREST PROTECTION AGAINST DESTRUCTIVE AGENCIES

(Preliminary Review Draft Subject To Revision)

FOREST SERVICE
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DEPARTMENT OF AGRICULTURE

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INDEX TO TIMBER RESOURCE REVIEW REPORTS AND APPENDIX MATERIAL

(Each Chapter and each Section, in the case of Chapters IV and IX, is a separate document)

CHAPTER IV. FACTORS AFFECTING FUTURE SUPPLY AND QUALITY OF DOMESTIC TIMBER

A. FOREST PROTECTION AGAINST DESTRUCTIVE AGENCIES

(Preliminary review draft subject to revision)

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September, 1955

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FOREST PROTECTION AGAINST DESTRUCTIVE AGENCIES[1/]

A considerable part of the timber volume added annually by growth to forests of the United States is offset by destruction from fire, insects, disease, animals, and adverse weather effects. In addition to the timber destroyed, growth is reduced, quality is impaired, land is left understocked, and other damage is sustained from these forest enemies. Since the magnitude of these losses is great, and since history shows us that occasional catastrophic losses may be expected to be compounded upon our relatively normal losses, it becomes obvious that in considering future growth needs allowance must be made for estimated future losses and means developed to keep them to a minimum. To the extent that the damage by destructive natural agencies can be reduced, the supply of timber available for use will be correspondingly increased.

The purposes of this analysis of damage to timber by destructive agencies are: (1) to present and compare the impacts of fire, insects, disease, and other destructive events in 1952 on timber growth; (2) to describe the types of damage by different destructive agents and their relative importance; (3) to analyze the status of efforts to reduce these losses; and (4) to appraise, in general terms, the extent to which losses may be reduced in the future.

The Basis for Evaluating Timber Destruction

There are many ways in which destructive agents affect growth. All of the major agents discussed herein, namely, fire, insects, disease, animals, and weather effects can kill trees. In addition, fires wound trees laying them open to wood borers and infection by heart rot fungi; or devitalize them, making them prey to bark beetles. Fires are a major cause of understocking, and can also deteriorate sites leading to inferior species composition and reduced growth of the more useful species.

Besides killing trees, insects and diseases can cause many other types of injury, destroying seeds and young seedlings, deforming and stunting saplings and poles, reducing growth by killing the foliage, and eating out the wood of large trees. Animals eat seeds, grub out seedlings, gnaw and claw at trees, browse and trample, causing a variety of types of damage. Everyone is familiar with the destruction resulting from certain caprices of weather--blowdowns, ice and snow damage, flooding and drought.

In attributing losses and damage to various agents in this review, a major effort has been made to reflect their full impact on growth. In many cases the mortality loss caused by an agent may be insignificant, and yet the annual loss in volume of sound standing timber may be very large. Thus, although the heart rots seldom kill trees, they lead all causes in amount of damage caused.

1/ In addition to the tabular data contained in this report more detailed information is included in the Appendix.

An understanding of this protection analysis requires an understanding of the terminology used to express damage to timber. The key terms are defined as follows:

Mortality - The volume removed from the total growing stock or the sawtimber portion of it, through death from natural causes, exclusive of catastrophic losses.

Growth loss - The losses sustained other than mortality, comprised of the sum of the following two elements: (1) Growth deficiency - The loss due to (a) delay in restocking or deficiencies in stocking resulting from a damaging attack or fire, and (b) the reduction in growth due to changes in timber type, defoliation, reduction of tree vigor, increase in cull percent, or deterioration of site; and (2) Loss of accumulated growth - The effect on present and prospective yields, of mortality of trees below the sizes measured: in the case of board feet, below sawtimber size; in the case of cubic feet, below 5 inches d.b.h.

Growth impact - Mortality plus growth loss.

Since the preponderance of damage from certain agencies is growth loss rather than mortality, as in the case of the defoliating insects, the heart rots, or the setback in growth from restocking failures or delays following fire, it is obvious that any real appraisal of damage must include an evaluation of factors causing a reduction in net growth in addition to volume loss through mortality.

Although the manner in which the growth loss figures presented in this report were computed varied depending upon the type of damage, the growth loss figures represent, in effect, the predictable loss in net growth for 1952 and into the future, resulting from damage that took place in 1952. In computing the damage from many diseases such as root and heart rots, and many insects, it was not possible to isolate the 1952 attacks, and in these cases mean annual loss is used to represent the loss due to the damage occurring in 1952.

As an example of growth loss we might consider a fire that killed 10 acres of 10-year-old loblolly pine. The fire killed few trees of measured size, but set the stand back one-fifth of the growth period commonly elapsing before harvest, which is about 50 years. If the initial stocking of this 10-acre area would have produced 50,000 board feet of sawtimber in 50 years, the growth loss resulting from the fire was 10,000 board feet, assuming immediate restocking. This destruction meant "loss of accumulated growth".

The destruction of sound wood by one current year's activity of heart rot fungi in California's softwoods is estimated at 453 million board feet. This is called growth loss, and is as real and tangible a loss as the 131 million board feet of timber killed by fire in California in 1952, or the 1,117 million board feet killed by bark beetles.

The growth impact data include such types of losses as result from the above fire in loblolly pine and the California heart rot, and represent the sum of the ultimate losses from all of the attrition events of 1952 as listed in the definitions of mortality and growth loss.

The timber losses due to catastrophic events, discussed later, are not included in any of the growth impact figures. These losses result from highly unpredictable events that are characterized by extremely severe and concentrated damage. Catastrophic losses are treated separately from the more normal losses in this report.

It is not too early to point out that comparisons of losses due to different destructive agencies and also contrasts among expenditures for direct control of each should be made with caution. Fire losses are substantially lower than those from diseases, primarily because of effective fire control programs. Also, certain insect and disease losses would have been much higher if control projects had not been promptly undertaken. A further complicating factor which must be considered in direct comparisons is that some bark beetle and heart rot losses are traceable to fire or fire losses to prevent insect outbreaks.

The fact that larger sums are not spent for direct control of insects and diseases does not necessarily indicate that progress is lacking in the fight against these destructive agencies. It must be remembered that control can be and to some extent is actually being achieved through indirect silvicultural measures by which high risk trees are removed for timber products before they are attacked or before they die. A share of the fire control expenditures are made to preserve watershed, grazing, or recreation as well as timber values, often on the same acres. Thus, the damage and cost information in this report must be used with the realization of such modifying factors.

Forest Protection as Analyzed in Past National Appraisals

In the past 25 years, three nationwide timber appraisals have been made and reports were published in 1933, 1941, and 1946. Each of these reports stressed that forest protection from fire, insects, disease, and other destructive agencies is necessary if we expect to get full timber production from our forest lands. Each presented statistics to show the magnitude of the losses from the major causes of timber destruction, as an indication of the size of the protection problem.

In all of the previous nationwide appraisals, estimates of timber drain from fire, insects, and disease were confined to the cubic feet, board feet, and cords of timber actually killed by these agencies. Estimates were not included on the amount of loss in current growth from insects and disease or the impact of these agencies on future growth, although these effects were recognized as important in their overall effect. Since the current review presents, for the first time, data on impact from fire, diseases, insects, animal damage, and weather effects separately, trends in reducing losses will be easier to measure in the future than is possible now.

Methods of reporting fire statistics have been on a systematic and fairly comparable basis for all agencies for many years, and so the total nationwide figures on fire occurrence and acreage burned are on a comparable basis in the three preceding reports already mentioned and this report. A review of the estimates of annual timber drain from fire shows a progressive reduction in damage from this cause.

The earlier appraisals reported timber destroyed by insects, disease, wind, and other destructive agencies to be from 3.4 to 3.9 billion board feet a year, or from two and one-half to four times the damage from fire. In these previous appraisals, the estimate of timber destroyed included only epidemic timber losses not salvaged, which were over and above the much greater but unestimated normal losses through death and decay which are continuously occurring in the forest. In the present appraisal, timber mortality from insects, disease, and causes other than fire include not only the epidemic or abnormal losses but the ordinary losses as well. Due in large part to this change to a more comprehensive and realistic definition of mortality, as well as a stronger base for estimating it throughout the country as a result of improved survey data, the present estimate of total mortality from these causes is more than three times that of earlier estimates. In addition to this, the damages defined in the concept of growth loss have been added, so that the total growth impact in cubic feet, from destructive events other than fire shown by the present report is more than nine times that of the mortality loss given in the national timber appraisal of 1946. Through the State by State appraisal of each element of mortality and growth loss, by causal agency and by the major tree species involved, there is no doubt that the growth impact data in this report come far more nearly approximating the loss from destructive agencies for a given year than the partial figures on mortality alone presented in past appraisals.

A comparison of past and present figures on timber losses might lead one to the conclusion that no progress had been made in the control of insects, disease, and other damage. Such a conclusion would not be justified, for substantial progress has been made in controlling many of the more serious insect and disease epidemics. The major changes in what is included in the present loss figures make comparisons with earlier figures of little value. The conclusion is warranted, however, that a tremendous volume of timber continues to be lost every year by the usual as well as the unusual activity of insects, disease, wind, and other natural agencies.

The conclusions of past reports as to the need for effective forest protection are again emphasized by the evidence presented in the present report. The only change is the one which shows that if we consider the total destruction by natural agencies, rather than merely the abnormal loss, the size of the problem of reducing the losses or utilizing the timber destroyed by these agencies is much greater than had been previously supposed.

THE IMPACT ON TIMBER OF FOREST DAMAGE OCCURRING IN 1952

Destructive Natural Agencies Take Heavy Timber Toll

The total growth impact from destructive agencies causing damage on commercial forest lands of the United States and Coastal Alaska in 1952 is estimated at 11.2 billion cubic feet of growing stock, including 43.8 billion board feet of sawtimber (table 1). These losses amount to over 92 percent of the sawtimber growth and 90 percent of the cut for 1952. The magnitude of timber destruction indicates that a combination of

Table 1.—Mortality, growth loss, and growth impact on commercial forest land resulting from 1952 damage, by causes (United States and Coastal Alaska)

Cause	Mortality	Growth loss	Growth impact	
GROWING STOCK				
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Percent
Fire	236	1,452	1,688	15
Disease	773	4,275	5,048	45
Insects	1,000	778	1,778	16
Weather	843	114	957	9
Animals	65	944	1,009	9
Miscellaneous[1]	593	136	729	6
Total	3,510	7,699	11,209	..
Salvage[2]	769	..	769	..
Net loss	2,741	..	10,440	..
SAWTIMBER				
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Percent
Fire	781	6,591	7,372	17
Disease	2,242	17,647	19,889	45
Insects	5,041	3,576	8,617	20
Weather	3,387	482	3,869	9
Animals	190	2,532	2,722	6
Miscellaneous[1]	1,026	332	1,358	3
Total	[3]12,667	31,160	43,827	..
Salvage[2]	3,089	..	3,089	..
Net loss	9,578	..	40,738	..

1/ Types of damage not ascribed directly to causes listed include suppression.

2/ Utilization from dead trees in 1952.

3/ The departure of these mortality figures from those for 1952 in Chapter III is accounted for because the Chapter III figures represent mean periodic trend mortality, while the above figures represent actual 1952 mortality.

better prevention, control, and utilization of this loss would go far in contributing toward our future timber requirements.

Of the total impact on sawtimber growth, 45 percent is estimated as due to disease, largely heart rots, while fire, insects, and all other causes taken together each contribute between 17 and 20 percent of the total (fig. 1). The wood used from dead trees in 1952 amounted to 22 percent of the 1952 mortality to growing stock, which is equivalent to only 7 percent of the total impact. The remainder, approximately 10 million cubic feet, is made up of wood produced and destroyed and wood not produced because of destructive agencies.

Fire is generally recognized as the greatest enemy of forests, because of its potential capacity to destroy timber and other forest values over vast areas in a short period of time. Due in a large measure to the effective effort in protection from fire given most of the forest lands in this country, the loss from fire of growing stock and of sawtimber was lower than comparable disease or insect losses (table 1).

Insects are charged with having killed the most sawtimber (table 1) accounting for 5,041 million board feet or 40 percent of the total mortality. They also caused a growth loss of 3,576 million board feet, having a total growth impact of 8,617 million board feet. Diseases had their greatest influence on growth loss, largely because of heart rots, so that in the growth loss category alone forest diseases accounted for 57 percent of the estimated growth loss in sawtimber from all causes. Because of this high growth loss plus the mortality with which they are charged, diseases accounted for 19,889 million board feet of growth impact, or over 45 percent of the total (fig. 1).

Still other causes of loss also loom large in the total effects from destructive agencies, mostly as a result of weather factors, particularly wind, and animal damage. These additional causes of loss accounted for 18 percent of the total growth impact in terms of sawtimber.

It is sometimes difficult to isolate any one cause of damage as more important than another because they may be so interrelated that much of the damage is due to a combination of causes. Fire often stimulates insect outbreaks by weakening timber, thus providing breeding places for insects. For example, the Tillamook burn and the Bandon fires in Oregon were followed by major Douglas-fir beetle outbreaks in green timber adjacent to these burns. In turn, insect outbreaks are frequently followed by damaging fires because of the extensive areas of inflammable fuels created by the insect attacks. In the hardwoods of the South, 77 percent of the cull is butt rot and 91 percent of this butt rot originated at fire scars. Insects are sometimes the carriers of tree diseases, as in the cases of the Dutch elm disease and the elm phloem necrosis. In other cases, insects follow behind diseases and complete the destruction of trees weakened by root rots or leaf diseases.

Windfalls frequently provide favorable material for breeding insects which emerge and then attack surrounding healthy timber. Hundreds of square miles of forests and 5 billion board feet of Engelmann spruce

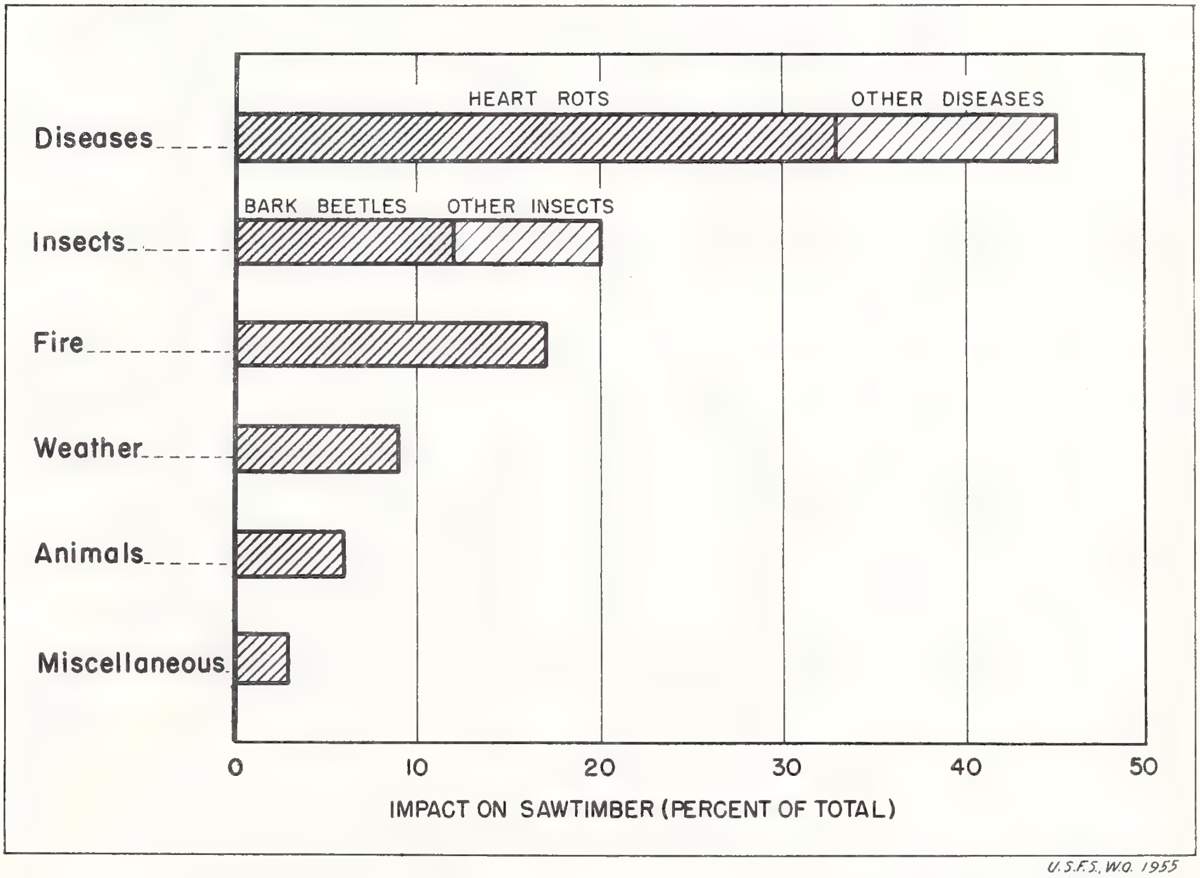

Fig. I - Impact on Sawtimber by Destructive Agencies as Percent of Total Impact, United States and Coastal Alaska

and lodgepole pine were killed in western Colorado between 1940 and 1951 from an outbreak of Engelmann spruce beetle which generated in a windfall of 1939. The western pine beetle, southern pine beetle, and birch dieback of the Northeast are definitely favored by drought. Lightning-struck pines are very frequently attacked by bark beetles, and lightning-struck oaks in Pennsylvania have become oak wilt centers. In the statistical material in this report, losses have been assigned to the agency most directly responsible.

Comparing the growth impact of forest damage in terms of sawtimber, by major causes, by sections of the country affected (table 2), we find that the greatest total losses were in the South, while the North contributed only slightly less and the West still less to the total. The North and the South contributed about equally to the national total regardless of the disparity in forest acreage of these two regions. From the standpoint of total impact on sawtimber from destructive agencies, three regions, the Southeast, the Pacific Northwest, and the Lake States, stood out, accounting for 47 percent of the national loss (table 3). In each case the major sources of loss differed somewhat. In the Southeast disease and fire were primarily responsible; in the Lake States animals and disease; and in the Pacific Northwest insects and wind were the main agencies.

Fire had its greatest impact in the South, particularly the Southeast and West Gulf, and in the Central States, and least impact in the West. Disease impact was greatest in the Southeast and most of the North and also high in most other regions. Insects exerted their greatest impact on the forests of the West, particularly the Pacific Northwest, California, and the Northern Rocky Mountain regions. Animal damage was highest in the Lake and Central States and parts of the South and West, and wind was very damaging in the Pacific Northwest and the Northern Rocky Mountains. The choice of any given base year would affect the regional rankings to some extent, particularly with respect to fire, insects, and wind damage.

Mortality Versus Growth Loss

Growth impact, as previously explained, is made up of two components; mortality and growth loss. Growth loss of sawtimber (table 1) was about two and one-half times greater than mortality. The relative proportions of mortality and growth loss vary widely between sections of the United States (table 4). Forty-eight percent of the growing stock mortality and 69 percent of the sawtimber mortality occurred in the West, where insects and wind are the principal causes of killing, while the North and South each contributed less than one-fourth as much as the West to the total sawtimber mortality.

When growth loss is added to mortality, so much of the growth loss occurred in the North and South, mostly due to hardwood heart rots, that the total growth impact on sawtimber was not greatly different in the three major sections of the country. Coastal Alaska added about 3 percent to the total U. S. mortality and about 2 percent to the growth loss.

Table 2.--Growth impact of forest damage on commercial forest land during 1952, by causes and by section (United States and Coastal Alaska)

GROWING STOCK

Cause	Section of U. S.			Total U. S.	Coastal Alaska	Total U. S. and Coastal Alaska
	North	South	West			
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
Fire	193	1,378	115	1,686	2	1,688
Disease	2,199	1,847	850	4,896	152	5,048
Insects	398	363	976	1,737	41	1,778
Weather	245	149	540	934	23	957
Animals	869	39	101	1,009	..	1,009
Miscellaneous	401	223	105	729	..	729
Gross impact	4,305	3,999	2,687	10,991	218	11,209
Salvage 1/	150	238	381	769	..	769
Net impact	4,155	3,761	2,306	10,222	218	10,440

SAWTIMBER

Cause	North	South	West	Total U. S.	Coastal Alaska	Total U. S. and Coastal Alaska
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Fire	886	5,802	680	7,368	4	7,372
Disease	7,983	6,953	4,323	19,259	630	19,889
Insects	1,414	1,461	5,569	8,444	173	8,617
Weather	597	575	2,609	3,781	88	3,869
Animals	2,451	87	184	2,722	..	2,722
Miscellaneous	505	558	295	1,358	..	1,358
Gross impact	13,836	15,436	13,660	42,932	895	43,827
Salvage 1/	280	615	2,194	3,089	..	3,089
Net impact	13,556	14,821	11,466	39,843	895	40,738

1/ Utilized from dead trees in 1952.

Table 3.--Growth impact of forest damage on commercial forest land during 1952, by cause and by section and region (United States and Coastal Alaska)

Section and region	Growing stock						Sawtimber					
	Fire	Disease	Insect	Other	Total		Fire	Disease	Insect	Other	Total	
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Percent	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Percent
North:												
New England	7	647	66	93	813	7	27	2,067	175	186	2,455	6
Middle Atlantic	46	550	67	253	916	8	297	2,245	165	320	3,027	7
Lake States	4	674	170	992	1,840	16	9	1,987	694	2,552	5,242	12
Central States	122	294	92	124	632	6	492	1,550	359	397	2,798	6
Plains	14	34	3	53	104	1	61	134	21	98	314	1
Total	193	2,199	398	1,515	4,305	38	886	7,983	1,414	3,553	13,836	32
South:												
South Atlantic	105	346	118	43	612	5	497	1,567	402	120	2,586	6
Southeast	923	1,142	139	210	2,414	22	3,804	4,086	547	640	9,077	21
West Gulf	350	359	106	158	973	9	1,501	1,300	512	460	3,773	8
Total	1,378	1,847	363	411	3,999	36	5,802	6,953	1,461	1,220	15,436	35
West:												
Pacific Northwest	61	270	436	388	1,155	10	375	1,431	2,518	1,769	6,093	14
California	32	191	244	99	566	5	197	1,134	1,452	259	3,042	7
Northern Rocky Mountain	10	288	210	115	623	6	39	1,296	1,205	542	3,082	7
Southern Rocky Mountain	12	101	86	144	343	3	69	462	394	518	1,443	3
Total	115	850	976	746	2,687	24	680	4,323	5,569	3,088	13,660	31
Total, United States	1,686	4,896	1,737	2,672	10,991	98	7,368	19,259	8,444	7,861	42,932	98
Coastal Alaska	2	152	41	23	218	2	4	630	173	88	895	2
Total	1,688	5,048	1,778	2,695	11,209	100	7,372	19,889	8,617	7,949	43,827	100

Table 4.--Mortality, growth loss, and growth impact on commercial forest land resulting from damage in 1952, by section (United States and Coastal Alaska)

GROWING STOCK

Section	Mortality	Growth loss	Growth impact	
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Percent
North	1,146	3,159	4,305	38
South	629	3,370	3,999	36
West	1,635	1,052	2,687	24
Total, U. S.	3,410	7,581	10,991	98
Coastal Alaska	100	118	218	2
Total, U.S. and Coastal Alaska	3,510	7,699	11,209	100

SAWTIMBER

Section	Mortality	Growth loss	Growth impact	
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Percent
North	2,079	11,757	13,836	32
South	1,768	13,668	15,436	35
West	8,428	5,232	13,660	31
Total, U. S.	12,275	30,657	42,932	98
Coastal Alaska	392	503	895	2
Total, U. S. and Coastal Alaska	12,667	31,160	43,827	100

The ratio of mortality to growth loss is very different for the major destructive agencies (fig. 2). The percentages of the total impacts, by causes, accounted for by mortality alone are as follows: 88 for weather, 81 for miscellaneous, 56 for insects, 15 for diseases, 14 for fire, and only 6 for animals where the major damage is browsing and interference with reproduction.

STATUS OF PROTECTION FROM FIRE

Fire Protection in Relation to the Timber Resource

It has become thoroughly established and accepted that control of fires is essential to the sustained management of forest resources. Fires can defeat the objectives sought by forest management, and a single blaze can completely wipe out timber values accumulated over many years. If merchantable trees survive fire, their growth rate and quality are often lowered. Fires damage future timber values when they destroy reproduction, saplings, and poles, especially if such burned areas fail to restock naturally. Hot fires and repeated burning are largely responsible for the lack of reproduction on the 73 million acres of forest lands now classed as poorly stocked. Fires often set the stage for later attacks by insects and diseases. They sometimes result in the replacement of desirable species by less desirable ones, and with severe or repeated burning may reduce the productivity of the soil itself. Fire control on many burned areas is more difficult, sometimes for decades, because of the snags fires create or the highly inflammable brush, annual grasses, and weeds that often invade burned areas.

Fire, however, is not always detrimental to forest management. Under certain circumstances it can be a useful tool. Burning creates a favorable seedbed for many species, and prescribed fire has often been used in the South to aid the natural regeneration of some pine species. In some cases it can be used to eliminate or check the growth of unwanted hardwoods or brush, help eliminate disease, or increase the production of browse or forage. Controlled fire is usually the most effective and practical means of eliminating logging debris on clear-cut areas to create conditions favorable for fire control and forest management. However, except when used under the control of rigid prescription, fire is a hazard to timber production.

The continuous threat of occasional severe losses characterizes the fire problem and the potential impact of fire on the timber resource. Historically we have suffered our greatest losses from the infrequent bad fire, an excessive number of fires in a short period, or a generally severe fire season. The Silverton fire of 1865 in Oregon burned an estimated 1,000,000 acres of forest land and killed enormous amounts of timber. The Peshtigo fire in 1871 in Wisconsin burned 1,280,000 acres and 1,500 people lost their lives. More recent catastrophic fires are mentioned in this report, among them the Yacolt fires in Washington in 1902, the great Idaho-Montana fires of 1910, and the Tillamook burn in Oregon in 1933. Today with tremendously improved fire control, we still suffer our greatest losses from the exceptional fire or the unusually bad fire situation. The impact to the timber resource will continue to result largely from this characteristic pattern of fire damage.

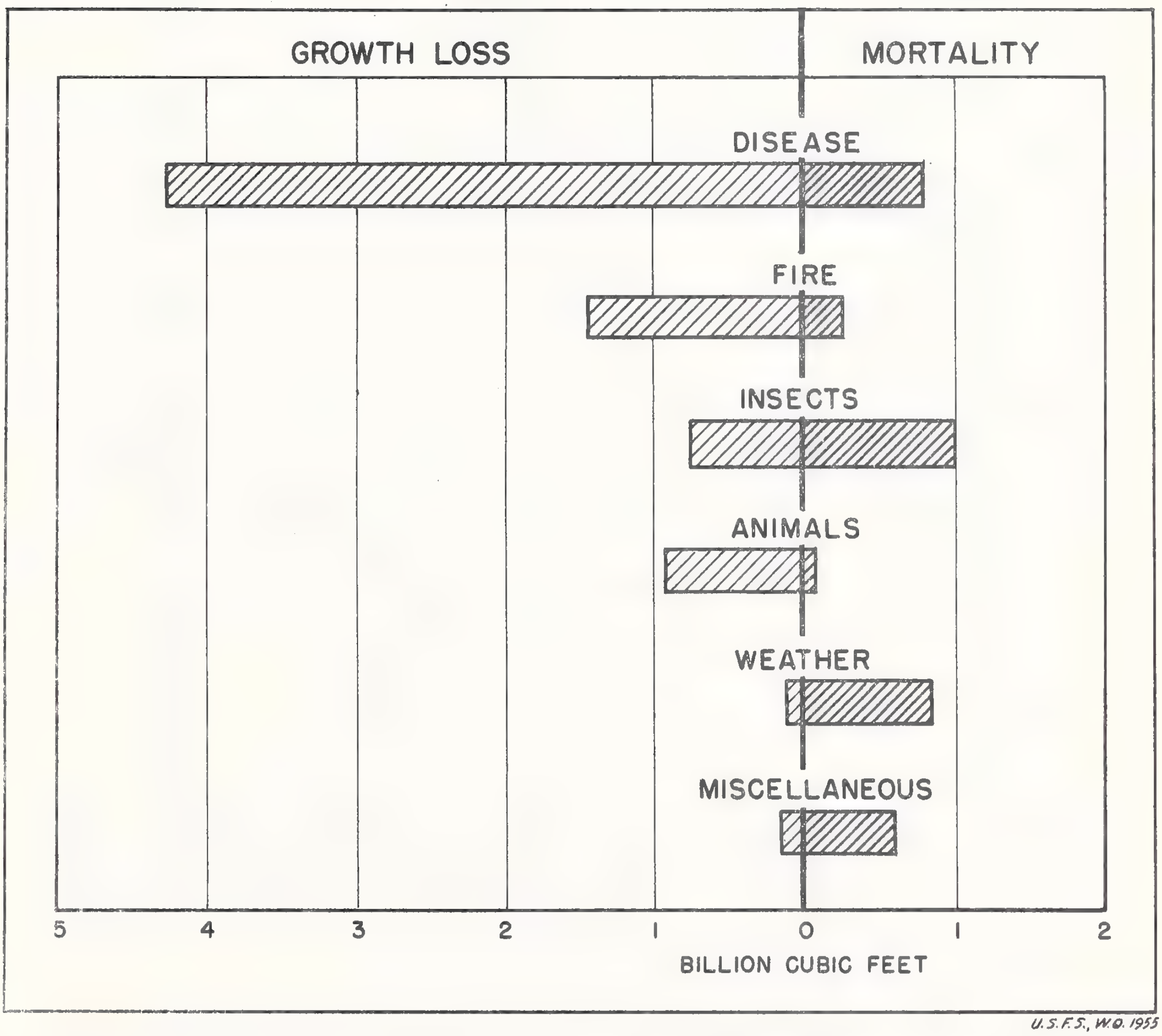

Fig. 2 - Growth Loss and Mortality Caused by Different Destructive Agencies, United States and Coastal Alaska

Total Impact on Growth is Substantial

The mortality caused by fire and the growth losses constitute a substantial growth impact on the timber resource. For example, the impact resulting from 1952 fires amounted to 1,688 million cubic feet of growing stock, including 7,372 million board feet of sawtimber. Because the severity of fire seasons fluctuates widely from year to year and place to place, the importance of growth impact can best be judged from annual averages. In table 5 growth impacts due to the average fire history of the years 1948 and 1952 show that losses were somewhat higher than those resulting from 1952 fires for the country as a whole.

Fire's greatest impact normally occurs in the South where about four-fifths of the losses, both to growing stock and sawtimber, are suffered. The 1952 fire season in the North was far more severe than usual and resulted in 193 million cubic feet of growth impact compared to 92 million for the average year. The reverse situation was true in the West where damages from 1952 fires were just half of those for the average year. Normally the cubic-foot growth impact for the North is 5 percent of the national total while that for the West is 13 percent.

Although the total growth impact for the South was far higher than for the other sections, the potential loss per acre in the West is 7 to 10 times greater than that for the South, because of the high per-acre timber volumes. Furthermore, many western fires are so intense that they kill entire stands of mature trees and also devastate areas that will not again become forest without costly planting projects.

Section	Growth impact per acre burned in 1952	
	Cu. ft.	Bd. ft.
North	54	247
South	145	610
West	1,027	6,071

As shown above the growth impact per acre in the South is two to three times that for the North. As old-growth timber with its typical high per-acre volumes gives way to lighter stands of second growth in the West, potential growth impacts will likely decline. Conversely, as inventories are built up in the North and South future per-acre impacts probably can be expected to increase.

Total Growth Loss Exceeds Mortality

Nationally, growth loss is six to eight times mortality: 1,452 million cubic feet compared to 236 million and 6,591 million board feet compared to 781 million (table 5 and fig. 2). An even greater contrast exists between these two categories of growth impact for the North and South, especially the latter. In these sections fires are generally of light or moderate intensity and their primary effect is on future growth and yield. In the South the natural resistance of cordwood-size or larger pine trees to killing by fire results in a low mortality compared

Table 5.--Growth impact from fires of 1952 and from fires of the average year, 1948-52, on commercial forest land (United States and Coastal Alaska)

Section	Growing stock					Sawtimber				
	1952			Average year 1948-52		1952			Average year 1948-52	
	Mortality	Growth loss	Growth impact	Growth impact	Percent of U.S. total	Mortality	Growth loss	Growth impact	Growth impact	Percent of U.S. total
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.		Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	
North	36	157	193	92	5	71	815	886	421	5
South	126	1,252	1,378	1,477	82	294	5,508	5,802	6,220	78
West	73	42	115	235	13	414	266	680	1,388	17
Total U. S.	235	1,451	1,686	1,804	100	779	6,589	7,368	8,029	100
Coastal Alaska	1	1	2	(1/)	..	2	2	4	(1/)	..
U.S. and Coastal Alaska	236	1,452	1,688	..	..	781	6,591	7,372	..	..

1/ Data not available.

to other losses. In the West, however, where fires tend to burn more fiercely, mortality exceeds growth loss by about 1.7 to 1; 73 million cubic feet compared to 42, and 414 million board feet to 266 million.

The Current Forest Fire Situation

An existing forest fire situation can best be characterized by the number of fires that occur, what causes them, where they start, and how extensively they burn over forest lands. Such a basis has been used to describe the fire problem that exists today.

Man-caused Fires Still a Problem

In 1952, as in many years previously, the activities of man were responsible for the vast majority of forest fires. Even in the West where lightning storms repeatedly swept over highly inflammable forests, more than half of the fires were man-caused. Of the 1952 total of 128,000 fires, 94 percent were man-caused and only 6 percent were due to lightning (table 6).

Industrial activities, mainly railroads and lumbering, accounted for 5 percent of the fires in 1952. Although no exact figures are available, these types of fires have sometimes been extremely damaging in the past. Railroad fires are concentrated in the valleys or near the bottom of slopes where topography is conducive to rapid spread. Fires that start in logging operations usually burn in heavy concentrations of slash that make them difficult to control even when small. Many loggers and most timber operators recognize the seriousness of lumbering fires and have made outstanding progress in recent years in preventing them.

The general public, the individual woods user, and the farmer are by far the greatest starters of fire. In 1952 almost 100,000 or 78 percent of all fires, were started by campers, smokers, debris burners, and incendiarists. Also, many of the 13,710 fires in the miscellaneous category were started by people. Continued effort to cut down the number of such fires obviously is needed if fire losses are to be reduced substantially in the future.

The South leads the Nation in numbers of fires with 86,000, or 67 percent of the total. Incendiarism, debris burning (mostly in connection with farming activities), and smoking accounted for 69,005 fires. With 82 percent of the growth impact occurring in the South, this part of the man-caused fire problem clearly holds the key to future timber losses.

In the North, smokers and debris burners started 16,625 of the 28,474 fires (58 percent) in 1952. That year this section had 22 percent of the national fire total. Of the eight categories listed in table 6, the lightning fire still is the greatest single fire starter in the West but smokers account for 17 percent of the western fire occurrence.

Area Burned in 1952 Near Current Average

The 1952 fire season was slightly more serious from the standpoint of acreage burned than the average year, with 14,711,000 acres being

Table 6.--Number of fires on protected land, by cause and section, 1952
(Continental United States)

Fire cause	North		South		West		Total, U. S.	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Lightning	384	1.3	1,446	1.7	6,182	46.0	8,012	6.3
Railroads	1,637	5.7	1,627	1.9	347	2.6	3,611	2.8
Lumbering	284	1.0	2,276	2.6	514	3.8	3,074	2.4
Subtotal	1,921	6.7	3,903	4.5	861	6.4	6,685	5.2
Camping	1,476	5.2	3,176	3.7	1,015	7.6	5,667	4.4
Smoking	8,160	28.7	15,190	17.6	2,314	17.2	25,664	20.0
Debris burning	8,465	29.7	16,178	18.8	1,173	8.7	25,816	20.2
Incendiarism	4,457	15.7	37,637	43.7	346	2.6	42,440	33.2
Subtotal	22,558	79.3	72,181	83.8	4,848	36.1	99,587	77.8
Miscellaneous	3,611	12.7	8,561	10.0	1,538	11.5	13,710	10.7
Total, all causes	28,474	100.0	86,091	100.0	13,429	100.0	127,994	100.0

burned over. In terms of commercial forest land burned the loss in 1952 was 13,210,000 acres compared to the 1948-1952 average of 12,133,000 acres (table 7). Sectional differences are most meaningful when compared on the basis of average annual losses. Furthermore, the impact from fire must be related to area of commercial forest that is burned. The most significant data in table 7, therefore, are the areas of commercial timber burned in the average year.

The situation is especially serious in the South where 84 percent of the losses on commercial forest land occur. The Southeast region, made up of only five States, has contributed 7,925,000 acres to the annual average of 12,133,000 acres burned. Here, obviously, is where the greatest impact on timber growth occurs. In the entire North and West together only 1,933,000 acres or 16 percent of the average national loss occurred. In spite of the favorable average situation in these sections or in any particular region the fact remains that in any one year an exceptionally heavy loss can occur. Thus, in 1952 the North burned twice its average and the Middle Atlantic region almost three and one-half times its average burned area.

Area Burned Mostly on Private Land

Almost 96 percent of the total 1952 burn occurred on lands in private ownership (fig. 3) with the remainder about evenly split between Federal and other public lands. Of the 14,082,000 acres burned on private lands 9,287,000 acres, or 66 percent, was in the South and 33 percent in the North, principally in the Central States (table 8). This burn was predominantly on commercial forest land. In terms of the total area of commercial and noncommercial forest land, the 1952 burned area on private land in the South was 5.2 percent compared to 3.3 percent for all private land and 2.2 percent for all forest land in the United States and Coastal Alaska.

Although the wood-using industrial owners, countrywide, are doing an effective job in protecting their holdings from fire, such ownerships comprise only 13 percent of the total commercial area. Other private landowners in many parts of the country still have a long way to go in reducing their big fire losses. Many such owners have not as yet been sufficiently concerned to obtain adequate protection. This is in contrast to the expanding interest and participation by increasing numbers of other private forest owners all over the country who are aiding the State foresters in providing Statewide protection and in many instances supplementing State protection to a standard that is higher than the level provided by the State.

A Look at the Status of Fire Control

Major Milestones in Fire Control

The initial step in the development of fire control on State- and privately-owned forest lands was taken by the large industrial owners in the West who became concerned about protecting their timber holdings. The first effective work outside of the national forests was started in Idaho in 1906 when timber protective associations were organized. The

Table 7.--Area burned on all forest land[1] and on commercial forest land only for 1952 and for the average year 1948-52 (United States and Coastal Alaska)

Section and region	Commercial and noncommercial area burned, 1952		Commercial area burned 1952	Commercial area burned Average year 1948-52	
	Thousand acres	Percent	Thousand acres	Thousand acres	Percent
North:					
New England	36	0.2	36	26	0.2
Middle Atlantic	748	5.1	746	217	1.8
Lake States	42	.3	24	45	.4
Central States	2,792	19.0	2,778	1,414	11.6
Plains	1,155	7.8	(2/)	2	(3/)
Total	4,773	32.4	3,584	1,704	14.0
South:					
South Atlantic	615	4.2	605	432	3.6
Southeast	7,381	50.2	7,342	7,925	65.3
West Gulf	1,676	11.4	1,567	1,843	15.2
Total	9,672	65.8	9,514	10,200	84.1
West:					
Pacific Northwest	66	0.4	61	75	.6
California	144	1.0	24	84	.7
Northern Rocky Mtn.	33	.2	14	19	.2
Southern Rocky Mtn.	23	.2	13	51	.4
Total	266	1.8	112	229	1.9
Total U. S.	14,711	100.0	13,210	12,133	100.0
Coastal Alaska	1	..	1	..	..
Total U.S. and Coastal Alaska	14,712	..	13,211	..	..

1/ Includes the burn on 10 million acres of nonforest lands in California and North Dakota, intermingled with or adjacent to forest lands.
2/ Less than 500 acres.
3/ Negligible.

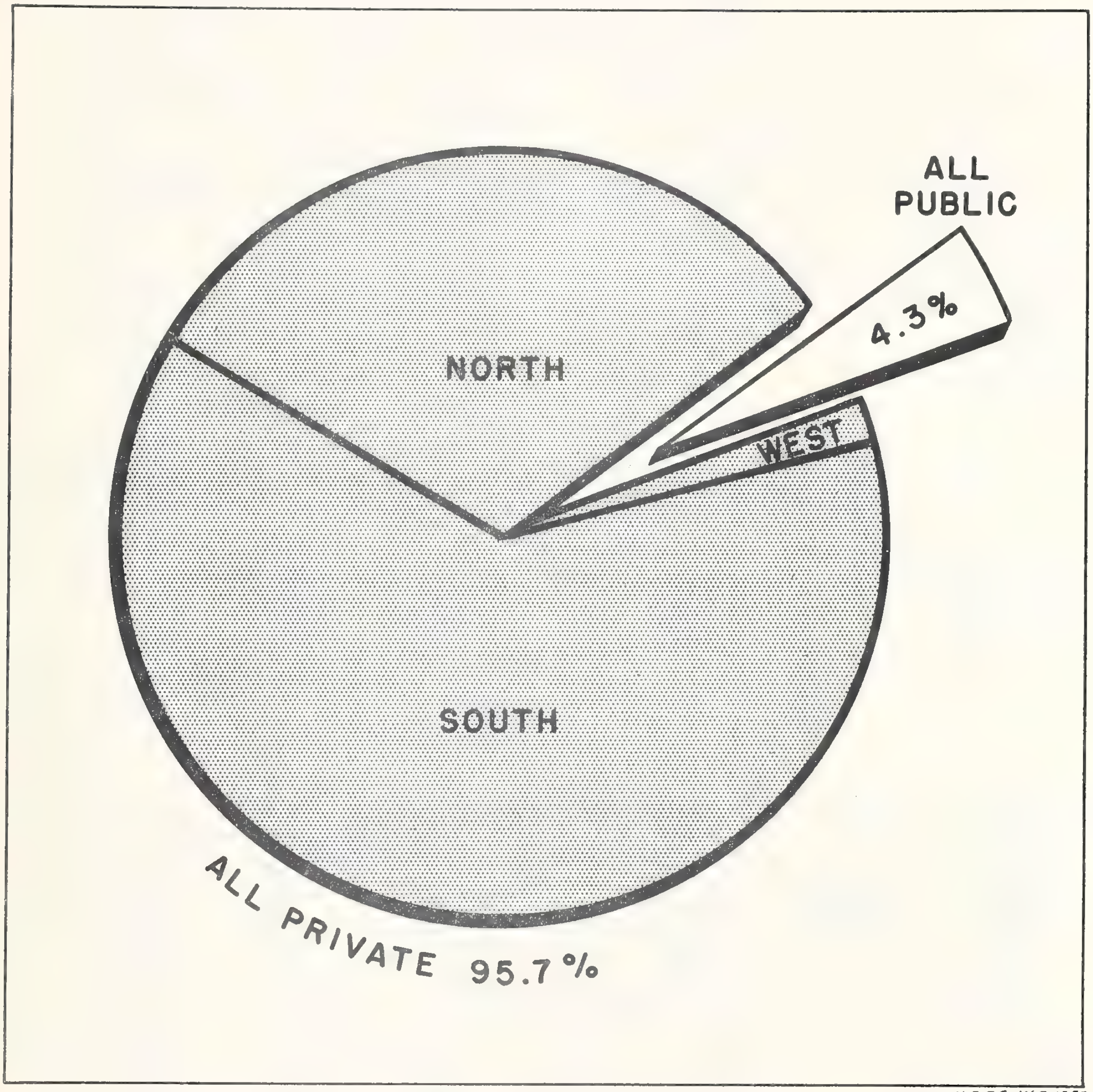

Fig. 3 - Area Burned on Commercial and Noncommercial Forest Land in 1952, United States and Coastal Alaska.

Table 8.--Area burned on commercial and noncommercial forest land[1] in 1952, by ownership (United States and Coastal Alaska)

Ownership	Area burned		
	Total	Percent of total burned area	Percent of all forest land
	Thousand acres		
Private:			
North	4,599	31.3	2.69
South	9,287	63.1	5.19
West	196	1.3	.26
All private	14,082	95.7	3.32
Federal:			
National forest	149	1.0	.11
Bureau of Land Management	30	.2	.08
Indian	64	.5	.36
National parks	1	(2/)	.02
Other Federal	118	.8	1.05
All Federal	362	2.5	.17
Other public	267	1.8	.80
All public	629	4.3	.25
All ownerships	1/14,711	100.0	2.18

1/ 1,501,000 acres of total burn was on noncommercial forest land and on nonforest lands in California and North Dakota, comprised as follows: 1,189,000 acres in North, 158,000 in South, and 154,000 in West.

2/ Negligible.

States also began to recognize their responsibility in protecting private lands from fire and by 1910, 16 had made a start toward organized fire control.

Two Federal legislative milestones gave impetus to the protection of State- and privately-owned lands; the Weeks Law of 1911, and the Clarke-McNary Act of 1924. Under the resulting cooperative fire control program which has proven highly effective, the States provide the administration and accept direct responsibility for supervising and handling the job. The Federal agency reimburses the States for specified expenditures and contributes leadership, technical help, and guidance when needed.

Over the years fire control on Federal lands has been provided in most instances by the agency charged with managing the land. Organized protection of the national forests began soon after the establishment of the Forest Service in 1905. The protection of these forests has improved steadily in spite of greatly increased industrial and recreational use and the coincident increase in fire risk and hazard. A large proportion of Federal lands, other than national forests, is administered by The Department of the Interior. Forty million acres were placed under protection in 1935 with the organization of The Bureau of Land Management. Most of the 18 million acres of forest land in Indian ownership or trusteeship and the 6 million acres in national parks have been under protection for many years.

Eighty-eight Percent of Lands Now Protected

Of the 673 million acres of land needing protection in the continental United States and Coastal Alaska[2/], 88 percent is under some form of organized protection (table 9). Most of the 82 million acres of unprotected land is in the North and South where the greatest burned area occurs. Of the 12 regions in the United States, only six have any substantial amount of unprotected land. From table 9 it will be noted that 41 million acres lie in the Central States and the Plains. The 11 million acres in the Central region are nearly all commercial land and much of the 1952 timber impact occurred on these acres. Most of the 30 million unprotected acres in the Plains is noncommercial forest area.

The most serious situation is in the South where 31,554,000 acres, almost all classified as commercial forest land, remains unprotected. The 9 million acres of unprotected land in the Southern Rocky Mountain region is almost all noncommercial forest land.

2/ The area which fire specialists consider to require protection includes all commercial and noncommercial forest land except approximately 900 thousand acres of widely scattered commercial woodland in Ohio and Iowa. Included in the 673 million-acre total are 10 million acres of nonforest brush and grass lands, closely intermingled with or adjacent to forest areas.

Table 9.--Commercial and noncommercial forest land[1/] requiring protection from fire, and area protected during 1952, by section and region
(United States and Coastal Alaska)

Section and region	Total area requiring protection[1/]	Protected	Unprotected	
			Area	Percent of total forest area
	Thousand acres	Thousand acres	Thousand acres	
North:				
New England	31,378	31,378	..	..
Middle Atlantic	44,894	44,894	..	..
Lake States	55,201	55,199	2	(2/)
Central	41,827	30,554	11,273	27
Plains	35,168	4,933	30,235	86
Total	208,468	166,958	41,510	20
South:				
South Atlantic	47,288	45,399	1,889	4
Southeast	96,906	79,657	17,249	18
West Gulf	53,071	40,655	12,416	23
Total	197,265	165,711	31,554	16
West:				
Pacific Northwest	54,131	54,131	..	..
California	52,082	52,082	..	..
Northern Rocky Mtn.	55,261	55,184	77	(2/)
Southern Rocky Mtn.	89,630	80,381	9,249	10
Total	251,104	241,778	9,326	4
United States	656,837	574,447	82,390	12
Coastal Alaska	16,508	16,508	..	..
Total	673,345	590,955	82,390	12

1/ Includes approximately 185 million acres of noncommercial forest land; of this total, 10 million acres is nonforest land in California and North Dakota. The total comprises 35 million acres in the North, 4 million acres in the South, 134 million acres in the West, and 12 million acres in Coastal Alaska.

2/ Negligible.

Most of Unprotected Land is in Private Ownership

Four hundred twenty-five million acres of land needing protection is in private ownership and 18.5 percent of this, or 78.6 million acres, is unprotected. The commercial part of these unprotected lands is primarily in the South and in parts of the Central region. As of 1952 the big share of such lands was in Florida, Mississippi, Tennessee, Louisiana, Arkansas, Kentucky, and Missouri; Oklahoma and Texas each have large areas of unprotected land but most of it is noncommercial. The acreage of protected and unprotected land by ownerships is shown in table 10.

Intensity of Protection is Highly Variable

Since the fire protection problem is characterized by extreme fluctuations in time and place as the activities of fire-starting agencies fluctuate and fire weather varies, it is almost axiomatic that the success of a fire control program depends on the ability of an organization to meet critical situations and peak load periods. A measure of the intensity or level of the fire protection effort is therefore a useful gauge in the evaluation of the status of protection.

To get a general measure of the adequacy of current protection for this review, the effectiveness of existing protection was rated in four broad classes. These classes express the ability of fire organizations, with their 1952 facilities, to meet successfully the critical situations of fire danger and numbers of fires that are typically encountered in each State and region. Definitions of the four classes follow:

Class 1 - Protection adequate to meet the fire situation in worst years and under serious peak load conditions.

Class 2 - Protection adequate to meet the average fire situation but failures likely in the worst years and under peak load conditions.

Class 3 - Protection adequate to meet fire situations only in the easy years and failures frequent in average or worse years.

Class 4 - Unprotected.

Ninety-nine million acres, or 15 percent of the total forest land, received Class 1 protection in 1952 (table 11). When viewed realistically, this area on which adequate protection can be achieved during the worst years, is relatively small. In contrast, 358 million acres, or 53 percent, received Class 2 protection. Control failures and heavy losses can be expected on Class 2 land during emergencies when organizations are swamped with an overload of fire work due to large numbers of fires burning under highly dangerous conditions. There is an additional 135 million acres, or 20 percent, which received Class 3 protection, on which frequent failures and heavy losses can be expected even in average years. During bad years the effort needed to meet emergencies on this poorly-protected area is an added overload on the 358 million acres of Class 2 land, making 73 percent of our forest area subject to heavy losses in extremely bad fire years.

Table 10.--Commercial and noncommercial forest land1/ requiring protection from fire, and area protected during 1952, by ownership (United States and Coastal Alaska)

Ownership	Total area requiring protection	Protected	Unprotected	
			Area	Percent of ownership area
	Thousand acres	Thousand acres	Thousand acres	
Private	424,694	346,080	78,614	18.5
National forest	140,268	140,268	0	0
Bureau of Land Management	39,661	39,528	133	.3
Indian	18,013	17,476	537	3.0
National park	5,933	5,933	0	0
Other Federal	11,253	10,473	780	6.9
Other public	33,523	31,197	2,326	6.9
Total	673,345	590,955	82,390	12.2

1/ Includes approximately 175 million acres of noncommercial forest land and 10 million acres of nonforest land in California and North Dakota.

Table 11.--Class of protection on all lands protected from forest fire during 1952 (United States and Coastal Alaska)

Ownership	Protected land			
	Class 1	Class 2	Class 3	Total
	Thousand acres	Thousand acres	Thousand acres	Thousand acres
Private	52,043	199,926	94,111	346,080
Federal:				
National forest	22,501	102,734	15,033	140,268
Bureau of Land Management	9,087	25,306	5,135	39,528
Indian	635	7,276	9,565	17,476
National parks	2,498	3,409	26	5,933
Other Federal	364	4,893	5,216	10,473
Total	35,085	143,618	34,975	213,678
Other public	11,593	14,008	5,596	31,197
All ownerships	98,721	357,552	134,682	590,955

A further analysis of the adequacy of protection on all forest land in relation to ownerships clearly shows that there is a big job yet to be done on the privately-owned lands. The percentage of such land under Class 1 and 2 protection is less than that for Federal and other public ownerships; 59 percent, versus 83 percent and 76 percent, respectively. Public and private owners, however, have about the same acreage of land under Class 1 protection. Table 11 and figure 4 show the comparative acreages in Class 1 and the other categories by various ownerships.

The North, with 29 percent of its land in Class 1, leads the country in high-level protection mainly because of the excellent protection achieved on private lands in the Middle Atlantic and Lake States regions, and on public lands in those regions and New England (table 12). The greatest opportunity for improvement in the North is in the Central States and Plains regions where only 6 percent in the Central States and a negligible amount in the Plains is under Class 1 protection.

In the South great opportunities exist to intensify protection and thereby reduce timber losses on commercial land. In this region only 1 percent of the land received Class 1 protection in 1952. Sixty percent had Class 2, 23 percent had Class 3, and 16 percent was unprotected. The South Atlantic region had the best record and significant strides have been made in recent years to intensify protection in these States.

The level of protection in the West was close to the national average with 14 percent of all land getting Class 1 protection. The Northern and Southern Rocky Mountain regions had the most adequate level of protection in the West, although there is still 10 percent of the Southern Rockies that is unprotected. The California region had 12 percent in Class 1 and 42 percent in Class 2. Much of the remaining 46 percent, which is all in Class 3, is extremely inflammable brush-covered land, highly important but on which fire has virtually no timber growth impact.

The Pacific Northwest region had only 1 percent of its area receiving Class 1 but 96 percent with Class 2 coverage. This gives the region one of the best over-all classifications although the problem of meeting extreme fire emergencies still exists on most of the area.

Fire Control Expenditures Are Substantial

The $63 million expenditure for the control of forest fires in 1952 is indicative of the determination of Federal, State and private landowners and managers to get on top of the fire problem. The steady increase in money spent for fire control by all agencies is shown by the following approximate expenditures:

Year	Expenditure
1932	$12,100,000
1937	15,400,000
1942	21,300,000
1947	44,600,000
1952	63,200,000

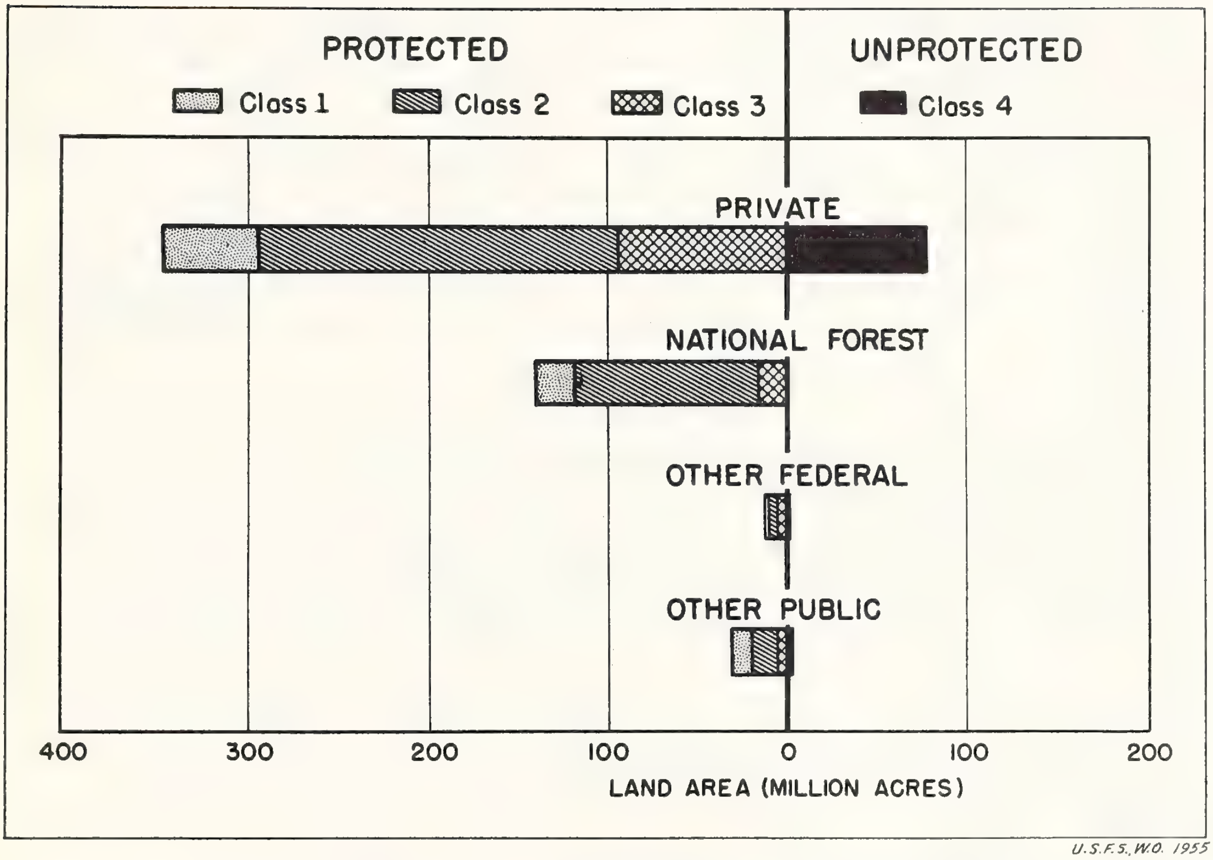

Fig. 4 - Intensity of Fire Protection, by Type of Ownership, United States and Coastal Alaska, 1952

Table 12.--Class of protection from fire on commercial and noncommercial forest land during 1952, by section and region, and by ownership (United States and Coastal Alaska)

Section and region	Federal forest land in protection class--				Other public forest land in protection class--				Private forest land in protection class--				All ownerships of forest land in protection class--			
	1	2	3	Unprotected	1	2	3	Unprotected	1	2	3	Unprotected	1	2	3	Unprotected
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
North:																
New England	93	7	..	..	61	39	..	..	25	75	(1/)	..	28	72	(1/)	..
Middle Atlantic	81	19	..	..	88	12	(1/)	..	62	21	17	..	66	20	14	..
Lake States	30	54	15	1	33	42	25	..	36	48	16	..	34	48	18	(1/)
Central States	2	80	18	(1/)	6	49	45	..	6	21	44	29	6	25	42	27
Plains 2/	3	2	41	54	7	..	21	72	..	1	11	88	(1/)	1	13	86
Weighted average	31	44	17	8	49	33	17	1	26	32	19	23	29	33	18	20
South:																
South Atlantic	11	82	7	(1/)	..	74	26	..	..	78	18	4	1	78	17	4
Southeast	1	88	10	1	(1/)	42	48	10	1	49	31	19	1	51	30	18
West Gulf	1	88	8	3	..	56	44	..	3	56	16	25	2	59	16	23
Weighted average	4	86	9	1	(1/)	52	42	6	1	58	24	17	1	60	23	16
West:																
Pacific Northwest	1	98	1	..	..	94	6	..	2	93	5	..	1	96	3	..
California 3/	13	34	53	..	41	59	..	..	11	49	40	..	12	42	46	..
Northern Rocky Mountain	16	72	12	..	21	67	9	3	19	52	28	1	16	69	15	(1/)
Southern Rocky Mountain	27	59	14	..	3	25	8	64	5	21	30	44	22	51	17	10
Weighted average	17	66	17	..	7	63	7	23	8	56	26	10	14	62	20	4
United States	17	66	16	1	34	42	17	7	12	47	22	19	15	52	20	13
Coastal Alaska	5	81	14	..	..	..	..	..	8	84	8	..	5	82	13	..
United States and Coastal Alaska	16	67	16	1	34	42	17	7	12	47	22	19	15	53	20	12

1/ Neglible.
2/ Approximately 500,000 acres of nonforest land included.
3/ Approximately 9,540,000 acres of nonforest land included.

Today almost half of the total fire control bill is in the West (table 13) where under hazardous combinations of fuel, weather, and topography, fire organizations have achieved considerable success but not completely satisfactory protection. About one-third of the total expenditures is in the South with a substantial part of the cost in the Southeast region. New England, the Middle Atlantic, and the Lake States regions account for most of the fire control dollars in the North.

Expenditures made in 1952 to protect private forest land totaled $43 million, or 67 percent of the national total. Slightly over $15 million, or 24 percent, was spent on the national forests. Expenditures on forest land of different ownerships in 1952 are shown in table 14.

It is not only of interest to examine where fire control funds are spent but also to analyze who foots the bill. In 1952 Federal sources paid 43 percent of the total cost, State organizations 40 percent, and private groups 17 percent. Actual amounts were as follows:

Source of Funds	Expenditures	Percent of Total
Federal	$27,211,000	43
State	25,505,000	40
Private	10,497,000	17
Total	$63,213,000	100

The States are shouldering a substantial part of the burden of protecting State and private lands. However, in addition to the expenditures listed above, many private agencies are raising the level of protection for selected high-value areas. They are financing hazard reduction along railroads, logging areas, and other dangerous places. The outstanding progress that has been made in expanding fire control is due in large measure to the combined efforts of State, private and Federal agencies in cooperatively attacking the job. The protection job remaining to be done can best be accomplished by a continuation of this joint effort.

Current Trends Toward Better Fire Control

The growth of fire control in the United States emphasizes the increasing support given by all agencies to this important activity. Nowhere in the world has such an extensive and highly-skilled fire organization been developed. But there are still trouble spots where improved protection is desirable. Current trends indicate the extent to which better fire control may be achieved in the near future.

Man-caused Fires Can Be Reduced

Cooperation, especially in forest fire prevention, has developed amazingly in recent years. The Cooperative Forest Fire Prevention program, under the sponsorship of the National Advertising Council, illustrates how effective the cooperation between Federal, State, industrial, and other private organizations can be. The "Keep Green"

Table 13.--Expenditures for forest fire control on commercial and noncommercial forest land1/ during 1952, by section and region (United States and Coastal Alaska)

Section and region	Fire control expenditures	
	Dollars	Percent
North:		
New England	2,343,300	3.7
Middle Atlantic	2,658,000	4.2
Lake States	4,758,400	7.5
Central	2,230,800	3.5
Plains	111,600	.2
Total	12,102,100	19.1
South:		
South Atlantic	4,207,200	6.7
Southeast	12,325,700	19.5
West Gulf	3,702,700	5.8
Total	20,235,600	32.0
West:		
Pacific Northwest	8,024,800	12.7
California	1/15,608,800	24.7
Northern Rocky Mountain	4,159,500	6.6
Southern Rocky Mountain	3,059,900	4.8
Total	30,853,000	48.8
United States	63,190,700	99.9
Coastal Alaska	22,100	.1
Total	63,212,800	100.0

1/ Includes expenditures for protecting 9½ million acres of non-forest land in California.

Table 14.--Expenditure for forest fire control during 1952 on lands of different ownerships (United States and Coastal Alaska)

Ownership	Fire control expenditures	
	Dollars	Percent
Private:		
North	9,713,300	15.4
South	17,730,600	28.0
West	15,224,000	24.1
All private	42,667,900	67.5
National forest	15,370,000	24.3
Other Federal	2,456,300	3.9
Other public	2,718,600	4.3
All public	20,544,900	32.5
U. S. and Coastal Alaska	63,212,800	100.0

programs in 36 States are outstanding examples of industrial and State cooperation. A multitude of other organizations and groups are working toward a common goal to reduce the number of man-caused forest fires.

The 7 percent reduction in number of fires in the decade ending in 1952, as compared to the previous decade, indicates major progress, but the gains made in fire prevention are far greater than this percentage would indicate. During this time the use of the forests for recreational purposes increased many-fold. Timber harvesting and other industrial uses of the forest have both increased, and large areas of high-hazard logging slash and more high-risk industrial areas have been created. The fact that the forest protection organization could reduce the reported number of fires by 7 percent over the previous decade in the face of these facts is impressive.

While a sustained nationwide effort is needed to hold the gains made, a great opportunity exists, especially in the South, to reduce the large number of man-caused fires, particularly those started by incendiarists. In the West better methods of hazard abatement are needed to prevent fires on cutover lands where high fire hazard follows cutting. Based on past progress, the indications are that adequate fire laws and regulations will be enacted or adopted in all States in the near future. Furthermore, progress may be expected in law enforcement. Thus, the trend is toward continued progress in all phases of prevention.

Protected Area Being Increased Rapidly

Although only 12 percent of the country's 673 million acres of forest lands that need protection are still without some coverage, 53 percent of the 1952 burned area occurred on these lands. In the average year almost three-fourths of the losses occur on the unprotected area. Thus, the extension of organized protection to this remaining 82 million acres is important, if future burned area is to be reduced significantly.

The outlook toward extending protection is bright because since 1945 the protected area has been increased by about 9 million acres per year. If the favorable trend continues, even at a slightly reduced rate, by 1960 the protected area will probably reach 630 million acres and by 1970 there should be virtually no important lands unprotected.

Intensification of Fire Control is Big Challenge

It was brought out earlier that only 15 percent of all forest lands requiring protection have a Class 1 level of protection and 53 percent have Class 2. Thus, 32 percent fall in the highly inadequate Class 3 category or are unprotected (Class 4). Figure 5 shows that area burned per million acres protected declines sharply as the percentage of land under Class 1 and 2 protection increases. This relation was determined from the records of 37 States which in 1952 experienced burning conditions severe enough to test the organizations responsible for protection.

In view of the characteristically heavy losses that occur during emergency fire periods it is obvious that the level of protection

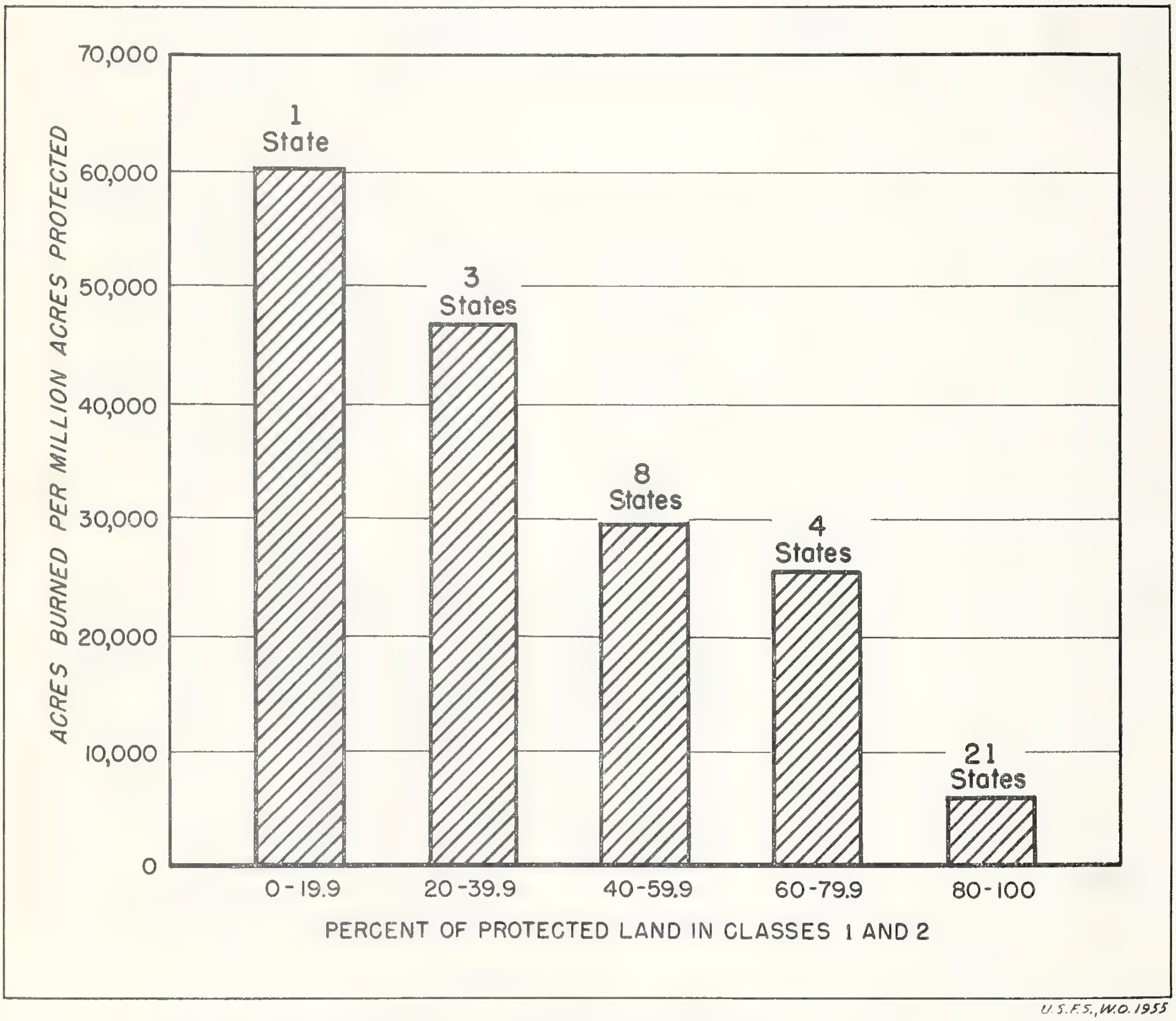

Fig. 5 - Area Burned per Million Acres Protected, 37 States, in Relation to Protection Status, 1952.

defined in both Class 2 and Class 3 is inadequate to prevent substantial fire losses during severe fire weather. If burned acreages are to be reduced, it will be essential that the level of protection be stepped up, not only by moving unprotected (Class 4) land into the Class 3 category but by intensifying organized effort all along the line. The Southern regions and parts of the Central States are faced with the biggest challenge. In the West, intensifying control efforts in some problem areas and keeping prepared against the continuous threat of serious losses will be difficult tasks.

Area Burned Trend is Favorable

The combination of (1) better fire prevention, (2) extended coverage of organized protection, and (3) gradually increased effectiveness of fire control has produced a steady reduction in area burned over the years. The downward trend in area burned since 1935 reflects the results of the Civilian Conservation Corps program of the 1930's, strengthened State fire control organizations, better leadership by all agencies, and greatly expanded fire control facilities and finances.

An anticipated expansion in fire control forces and facilities will result from forest fire protection compacts that have been organized among the States. These compacts, Federally authorized, enable and encourage member States to develop integrated forest fire plans, to maintain adequate forest fire fighting services, to provide for material aid in fighting fires, to establish a central agency to coordinate services between States, and to perform such common services as member States may deem desirable. These compacts and new ones in the future will be of tremendous help in maintaining the downward trend in burned area with a minimum of added cost.

The area burned (fig. 6), which has dropped steadily since the 1930's, is expected to level off gradually in the next 10 to 15 years. The biggest reductions yet to be made will likely be on unprotected lands.

It is estimated that by 1960 the area burned on all 673 million acres of lands needing protection will have fallen to 8,751,000 acres for continental United States. This figure represents a reduction of almost 6 million acres, or 40 percent, in annual burn compared to 1952. The distribution of the anticipated acreage burned in 1960 by sections is:

Section	Estimated Burn in 1960	Proportion of total forest area
	M acres	Percent
North	1,213	0.6
South	7,181	3.6
West	357	0.1
Total U. S.	8,751	1.3

There are still many ways to achieve better fire control at less cost and progress will depend, to a substantial degree, on forest fire

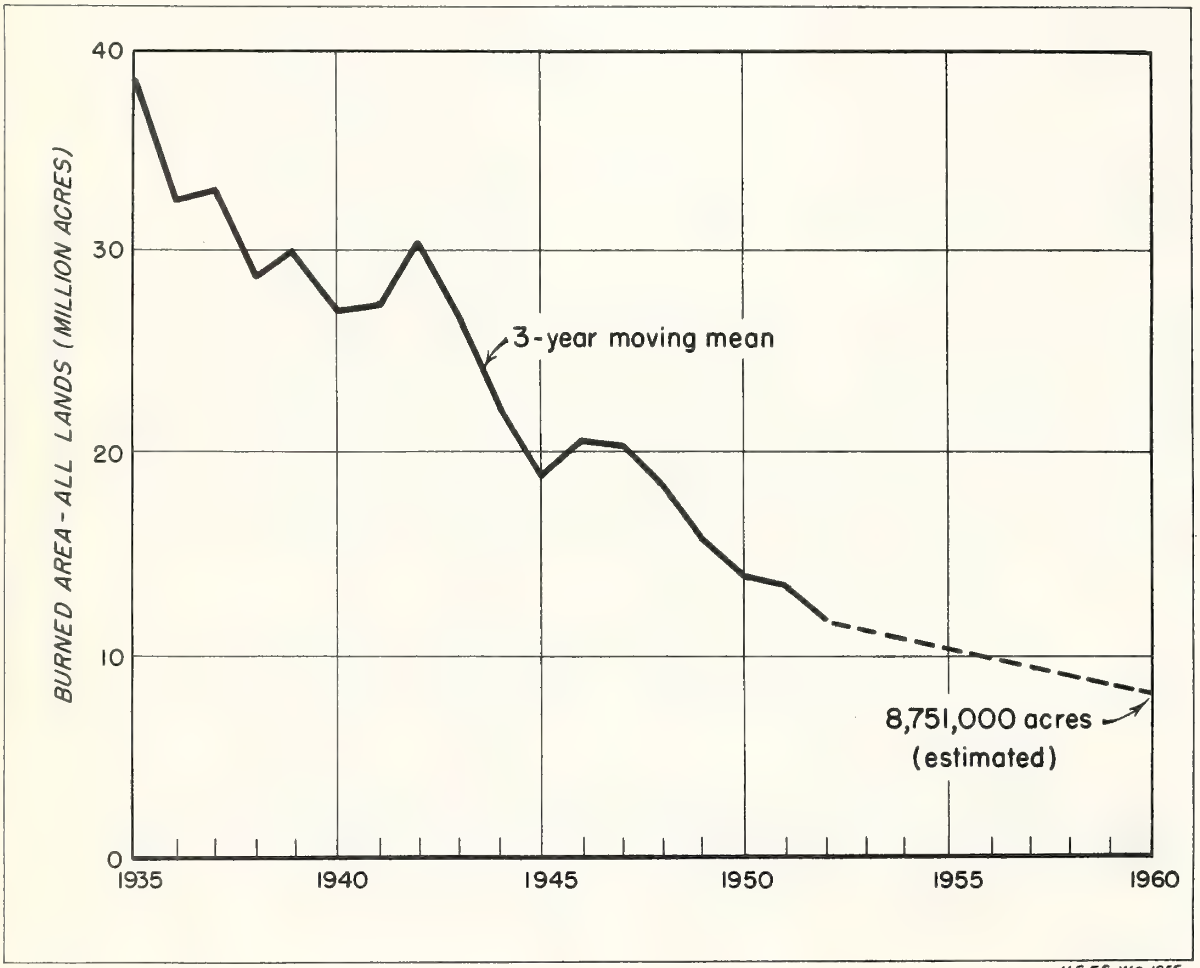

Fig. 6 – Trend in Area Burned in Continental United States, 1935 - 52

research. As we learn more about fire behavior, develop new equipment and techniques for fire suppression, and uncover new and effective ways of preventing fires, greater returns from fire control efforts will result.

STATUS OF PROTECTION FROM DISEASES

Tree diseases operate in many ways that reduce the final yield of timber stands and the quality of the wood produced. Root diseases kill or stunt large numbers of trees. Bark diseases may girdle and kill trees or produce open wounds leading to decay. Wood-rotting diseases reduce or destroy the merchantability of timber. Leaf and needle diseases check growth and sometimes kill.

Most of our forest tree diseases are native, that is, so far as we know have always existed in this country. This group includes most of our heart rots and many other normally endemic diseases. Native diseases, however, sometimes become temporarily epidemic. Many of our most destructive diseases, for example white pine blister rust and chestnut blight, are not native but are known to have been introduced into this country from other continents. Parasites brought into a new region often find some tree species particularly susceptible to their attack, partly because of the lack of any established balance between parasite and the new host. This results in an epidemic.

Since the turn of the century a large number of serious or potentially serious diseases have attracted attention in this country. Some definitely were inadvertently introduced from foreign lands. The source of others is not known. Still others have very likely resulted from epidemic behavior of normally endemic diseases. The following is a list of some of the more outstanding outbreaks of diseases regarded as new to this country since about 1900:

Disease	Species attacked	Cause	Year first reported 1/
Chestnut blight	Chestnut	Fungus	1904
Blister rust	5-needled pines	Fungus	1906
Phloem necrosis	Elms	Virus	1918
Beech bark disease	Beech	Fungus & insect	1920
Larch canker	Larches	Fungus	1927
Pole blight	Western white pine	Unknown	1929
Birch dieback	Birches	Unknown	1930
Dutch elm disease	Elms	Fungus	1930
Littleleaf	Short. & Lob. pine	Fungus	1932
Persimmon wilt	Persimmon	Fungus	1933
Oak wilt	Oaks and chestnuts	Fungus	1942
Pitch canker	Hard pines	Fungus	1945
Sweetgum blight	Sweetgum	Unknown	1951

1/ In some cases, notably oak wilt, littleleaf, and phloem necrosis the diseases were almost certainly present many years before they were identified as specific diseases.

Some diseases such as chestnut blight, have caused catastrophic losses. Others such as blister rust, are being held in check in most areas through rigorous control efforts; others such as littleleaf are being combatted through adjusted management practices, and still others are at present mainly in the status of threats, such as oak wilt and sweetgum blight, or of no great importance to our timber resource, such as persimmon wilt. During the past half century the incidence of "new" diseases presents no clear trend. For the five decades included, the number of serious new forest diseases reported varied from two to four per decade, with a peak in the thirties.

In addition to the diseases reported above as new since 1900, there have been build-ups of major consequence, often associated with abnormal weather or changes in forest conditions, on the part of several diseases native with us, or naturalized many years ago. Diseases of this type that have risen in importance at one time or another since 1900 include Elytroderma needle cast on ponderosa pine, *Poria weirii* root rot of Douglas-fir, and fusiform rust of southern pines.

In the tables in this report dealing with growth impact from destructive agents, the losses from all types of events are included, whether epidemic, introduced, or native. The only exceptions are the losses from those individual catastrophic events that are listed in table 22.

Diseases Reduce Our Timber Supply

Earlier in this report it was brought out that diseases are responsible for 22 percent of the growing stock mortality and 56 percent of the growth loss, representing 45 percent of the total national growth impact. While this tremendous volume loss is composed of major damage by many diseases, 3.4 of the 5.0 billion cubic feet is ascribable to the heart rots alone. The bulk of the growth impact from diseases is growth loss rather than mortality (table 15, and fig. 2). Such diseases as the heart rots, leaf diseases, and killers of seedlings and saplings cause little mortality loss of measurable volume, yet account for the larger share of the ultimate effect of disease on wood volume production.

The damage from disease is not localized in any particular section of the country (table 16). Thus, 40 percent of the Nation's 1952 growth impact from disease on sawtimber is in the North, largely the Northeast and Lake States, 35 percent is in the South, 22 percent in the West, and 3 percent in Coastal Alaska.

Many Kinds of Diseases Cause Major Losses

The following is an account of the more important diseases, discussed in decreasing order of damage due to 1952 events, on the basis of sawtimber loss:

Heart rot can take place in any tree exposed to infection as a result of injuries, old age, or natural pruning, and occurs in all tree species and in all regions. The cull that the rots cause limits the optimum rotation age for many species, becoming critical, for example,

Table 15.--Mortality from disease compared with growth loss, by section, 1952 (United States and Coastal Alaska)

GROWING STOCK

Section	Mortality	Growth loss	Growth impact
	Million cu. ft.	Million cu. ft.	Million cu. ft.
North	461	1,738	2,199
South	73	1,774	1,847
West	190	660	850
Coastal Alaska	49	103	152
Total, U. S. and Coastal Alaska	773	4,275	5,048

SAWTIMBER

Section	Mortality	Growth loss	Growth impact
	Million bd. ft.	Million bd. ft.	Million bd. ft.
North	914	7,069	7,983
South	233	6,720	6,953
West	891	3,432	4,323
Coastal Alaska	204	426	630
Total, U.S. and Coastal Alaska	2,242	17,647	19,889

Table 16.--Growth impact of damage by disease on commercial forest land during 1952, by section (United States and Coastal Alaska)

Disease	Growth impact to growing stock: North	South	West	Coastal Alaska	Total, U.S. and Coastal Alaska	Growth impact to sawtimber: North	South	West	Coastal Alaska	Total, U.S. and Coastal Alaska	Percent of total impact
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	
Root:											
Douglas-fir root rot	..	..	96	..	96	..	..	454	..	454	2.3
Littleleaf	..	43	..	..	43	..	146	..	..	146	.8
Stem:											
Heart rots	1,511	1,487	309	62	3,369	6,405	5,840	1,928	332	14,505	72.9
Blister rust	103	..	46	..	149	349	..	274	..	623	3.2
Dwarf mistletoe	9	..	171	..	180	3	..	577	..	580	2.9
Fusiform rust	..	97	..	..	97	..	281	..	..	281	1.4
Hardwood cankers	152	..	..	..	152	186	..	..	..	186	.9
Foliage:											
Brown spot	..	16	..	..	16	..	59	..	..	59	.3
Elytroderma needle cast	...	..	9	..	9	..	..	46	..	46	.2
Systemic:											
Birch dieback	216	..	..	..	216	494	..	..	..	494	2.5
Pole blight	..	..	14	..	14	..	..	61	..	61	.3
Oak wilt	13	..	..	..	13	47	..	..	..	47	.2
Sweetgum blight	1	47	..	..	48	1	41	..	..	42	.2
Miscellaneous	194	157	205	90	646	498	586	983	298	2,365	11.9
Total, all diseases	2,199	1,847	850	152	5,048	7,983	6,953	4,323	630	19,889	100.0

in aspen at about 50 years, balsam fir at 70 years, scarlet oak at 100 years, white fir at 150 years, and Site II Douglas-fir not until 300 years. In the case of eastern hardwoods damaged by fire, 45 percent of the monetary damage following the average burn results from heart rot that develops from the basal scars. It has been common practice in the past, but to a lesser extent today, to leave badly decayed trees standing following logging, thus increasing the proportions of rotten cull trees occupying the sites. Our past high heart rot losses have been in part related to this practice of "high-grading".

Blister rust losses are being held to a low level by the control program in most of the East. On private lands in the Lake States the rust is causing material damage to young stands, which represent the predominant age class of the region. In the Northern Rocky Mountain region the rust has become established throughout the range of white pine. Although losses are already heavy in the Inland Empire, the rust's full effect there has not yet reached its peak. In California the rust has spread south to the central Sierra Nevada, and is causing considerable damage in the northern end of the State.

The dwarf-mistletoes lead the diseases in amount of damage caused in the Southern Rocky Mountain region, and also cause considerable damage to ponderosa pine, lodgepole pine, and Douglas-fir elsewhere in the West, and to black spruce in the Lake States. Trees of all sizes are attacked. Some are killed before they reach merchantable size, and others are stunted in growth for long periods.

Birch dieback, New England's most devastating diseases since the chestnut blight, resulted in a 1952 growth impact of 494 million board feet. Its exact nature and cause are not completely understood, but there can be little doubt that reduced rainfall and abnormally high temperatures are implicated, and the bronze birch borer has added to the destruction by killing many trees weakened by dieback. Since 1930, birch dieback has decimated much of the yellow and paper birch in New England and adjacent Canada.

The root rot caused by Poria weirii attacks many western conifers, but is particularly serious on Douglas-fir in the Pacific Northwest, where it is known to severely attack stands as young as 20 to 60 years old. There is no question but that this disease, with a current annual growth impact of 454 million board feet, has become a major silvicultural problem in the Northwest.

Fusiform rust is the most important disease of loblolly and slash pines. The alternate hosts for this southern rust are the oaks. Although trees of all ages are susceptible, the cankers that kill seedlings and saplings are the most damaging. The disease continues to increase as fire protection favors the increase in oak over pine and also increases the proportion of loblolly and slash pines at the expense of the more rust-resistant longleaf.

The hardwood canker diseases attack a wide range of species, expose the trunks to decay and lead to cull, wind breakage, and reduced wood quality. They are important primarily in New England, and the Middle

Atlantic, Central, and Lake States. Hypoxylon canker of aspen causes by far the most serious disease mortality loss in the Lake States.

Littleleaf, a fungus root disease associated with poor internal soil drainage and soil deterioration, attacks shortleaf and to a lesser extent loblolly pine. It is the most important silvicultural problem in shortleaf management in much of the Piedmont and in the upper coastal plain of Alabama. It reaches important proportions on 6 million acres from Virginia to Mississippi, and occurs in scattered stands over a wider acreage, with a total current annual growth impact of 146 million board feet.

Pole blight is a disease of undetermined cause, characterized by dieback and gradual decline of the entire crowns, leading to the complete breakup of large areas of pole-sized western white pine. Almost the entire pole blight growth impact loss of 61 million board feet is in trees from 8 to 20 inches in diameter. Pole-blighted stands now occupy 92,000 acres in northern Idaho and adjacent Washington and Montana.

Brown-spot is a fungus disease of the needles, and one of the main causes of longleaf pine remaining in the "grass" stage for many years before starting height growth. Where brown-spot is controlled by either prescribed burning or by foliage sprays, early height growth has been initiated and the time required to grow a crop of longleaf pine reduced as much as 20 percent.

Oak wilt is currently the most highly publicized tree disease in the Nation. Since it is a virulent killing disease to which all oak species tested are susceptible, it deserves the attention it is receiving. There is strong evidence that the disease has been in Wisconsin and Iowa for 40 years or more. More recently it has been found scattered over a wide area in the Lake and Central States, from Pennsylvania to North Carolina, and westward through Tennessee and northern Arkansas to eastern Kansas and Nebraska. Oak wilt has destroyed great numbers of oaks in the Middle West and many oak areas from a few to about 100 acres in extent, in Wisconsin and Iowa, have been practically denuded. The wilt has been slowly but definitely spreading in the Appalachians and Pennsylvania. In terms of current impact on our Nation's oak supply, oak wilt has not had a great effect (table 16), and its importance lies in the threat that if left uncontrolled, it could gradually build up to serious economic proportions over much of our oak timberland.

Sweetgum blight is a newly recognized disorder of unknown cause characterized by dieback of the crown or rapid death of entire trees. It occurs in varying degrees in all States where sweetgum grows. A particularly spectacular dying of sweetgum has been taking place in recent years in Maryland and Delaware which may be an aggravated stage of the blight that occurs elsewhere in the South or may prove to be a separate disease. The 42 million board feet of damage from sweetgum blight is made up of the two types combined.

Elytroderma needle cast is a serious disease of ponderosa pine through southern Idaho and eastern Oregon, and small outbreaks are currently active elsewhere in Idaho, as well as in parts of Montana and

California. During the past eight years, it has killed outright at least 50 million board feet of high quality timber in the Pacific Northwest and has transformed thousands of good trees into high risks likely to succumb to insect attack.

Miscellaneous diseases not listed individually, through their attacks in 1952, will have an impact on growth of over 2,300 million board feet, which is 12 percent of the impact from all diseases. This group includes many stem rusts, root rots, leaf and needle diseases, and forest losses from such epidemic diseases as the Dutch elm disease, phloem necrosis of elm, and persimmon wilt.

Advances Being Made in Disease Control

Disease Surveys, the First Step Toward Control

Forest disease surveys are essential to learn what diseases we have and something of their importance, to detect the presence of new threats, to appraise the extent and damage of known diseases for planning purposes, and to delimit outbreak areas for control purposes. For the initial detection of new disease threats considerable dependence is placed on the evergrowing field force of foresters, pathologists, other specialists, and woods workers. Appraisal surveys, so essential to gauge the scope of attack and the possibilities for and costs of control, received great impetus with the passage of the Forest Pest Control Act of 1947, the functioning of which is explained in the final section of this report. The appraisal survey program, which has been successfully applied to oak wilt, pole blight, larch canker, sweetgum blight, and birch dieback is inadequate to meet the full needs of control planning, estimation of damage, and the determination of research required.

Control surveys are those conducted in a control area to locate the stands or trees requiring treatment. They led to the control of larch canker in New England, and are in wide use in the blister rust control program and in the suppression of oak wilt in the eastern and southern States. The States have played a vital part in the financing and operation of the blister rust and oak wilt surveys, and are assuming a major role in forest pest detection and survey in general.

Direct Control Necessary Against Some Diseases

In the sense that it is used here direct control refers to efforts and expenditures made specifically and solely for the control of a given disease, and not those activities worked in as a part of normal silviculture. Most current forest disease control is considered indirect in that it is effected through adjustments in forest management. Of the few current programs of direct control of forest diseases the largest, by far, is the blister rust program. Three of the eight native white pines in the United States are important timber species, and are being protected against blister rust.

Federal, State, and private agencies cooperate in blister rust control. Federal funds are made available to the Department of Agriculture for

over-all leadership, coordination, and technical direction, for control work on national forest lands and on non-Federal lands in cooperation with State and private agencies, and to the Department of Interior for work on Indian, national park, and other lands under its supervision. Satisfactory control involving the removal of currant and gooseberry plants, the alternate hosts of the disease, from the control areas, has been established and is being maintained on three-fourths of the Nation's primary white pine areas. The remaining one-fourth includes high-hazard areas in the northern Lake States, Idaho, and parts of Oregon and California.

Several States east of the Mississippi River have active oak wilt control programs, some of which are in cooperation with the Federal Government. The tree removal and treatment phase of this program was, in 1952, carried on entirely by the States.

The use of prescribed fire for the control of brown-spot in longleaf pine seedlings is now in wide use in the South. When properly used these fires consume diseased foliage with little damage to the trees, checking subsequent infection long enough to stimulate growth. Furthermore, such burns reduce the forest fuel, reduce grass competition, and at least temporarily improve spring forage, so only part of the cost of the prescribed burning of seedling longleaf is chargeable to brown-spot control.

Only recently have large-scale attempts been made to control dwarf-mistletoe by cutting infected trees, although the effectiveness of mistletoe elimination as a means of control has been apparent for several years. In 1952 the Federal Government supported such a program on some of the national park and Indian lands of the Southwest.

Some larch cankers, in addition to those found and removed following discovery of the disease in 1927, were found by disease survey crews in 1951 and 1952 and the infected trees were destroyed. The remainder of the current direct control efforts against forest diseases include small-scale efforts against a large number of diseases both in plantations and natural stands.

The expenditures for the direct control of forest diseases in 1952 totaled $3,857,300, approximately 80 percent of which was spent by the Federal Government (table 17). Ninety-seven percent of this Federal expenditure went to the blister rust control program. Of the States' share 80 percent went to blister rust, 13 percent to oak wilt, and the remainder to other diseases. The Nation's effort in forest disease control cannot be appraised fairly by the expenditures listed in table 17, since these were only the direct costs and were made largely for the control of one disease.

Disease Control Through Silviculture Gaining Ground

Most control efforts against forest diseases are predicated on adjustments in forest management practices. The impacts of many of the diseases listed in table 16 can be materially lessened through corrective silvicultural measures.

Table 17.--Expenditures for direct control of forest diseases, 1952 (Continental United States)

Disease	State and private	Federal	Total
	Dollars	Dollars	Dollars
White pine blister rust	608,700	2,995,000	3,603,700
Oak wilt	101,700	25,900	127,600
Brown-spot (longleaf pine)	17,000	34,800	51,800
Dwarf mistletoe	0	19,000	19,000
Fusiform rust (southern pine)	8,900	600	9,500
Larch canker	200	6,200	6,400
Miscellaneous diseases	23,800	15,500	39,300
Total	760,300	3,097,000	3,857,300

Heart rots are major factors in determining the best rotation age for many species, particularly when they become critical at early ages, as in aspen and balsam fir. The changed cull status between the old unmanaged southern pine timber and the younger second-growth forests of today indicates the relation between over-age and heart rot, since cull in the old timber usually made up over 20 percent of the volume, while the mean southern pine rot cull in 1952 was estimated at only 3 percent.

Butt rot losses are being reduced through fire protection and greater care in logging. Trunk rots are being reduced through reducing logging damage, removing high rot-risk trees in partial cuts, making salvage cuts in badly damaged stands, pruning in the case of ponderosa pine, and with some highly rot-susceptible trees, adjusting rotation ages to minimize decay loss.

Dwarf-mistletoe damage can be reduced by removing the parasite from the overstory in the course of harvesting, and by the removal of small infected trees in conjunction with stand improvement operations. These measures, however, are not yet in wide use. There have been gradual increases in partial cutting and stand improvement practices in which weak, diseased, damaged, or otherwise undesirable trees are removed. Through such sanitation cuttings losses from many diseases, including littleleaf, fusiform rust, dwarf-mistletoe, and the hardwood cankers are being reduced. Since littleleaf is largely confined to certain soils, a beginning has been made toward replacing shortleaf with other species on the littleleaf soils.

In the prescribed burning program for longleaf pine, brown-spot control is one of the several silvicultural objectives in this use of fire. In deciding on the proper spacing in slash and loblolly pine plantations the high incidence of rust following the wider spacings is an important consideration. Maintaining high-stand density reduces Hypoxylon canker losses in aspen. Even in the case of blister rust forest management practices have a direct bearing on control.

Some diseases have killed such large concentrations of timber that it has been profitable to conduct salvage operations. The salvage of blight-killed chestnut is a notable case in that about 32 percent of the timber killed by the blight over a dozen States has been salvaged and dead chestnut is still being utilized. Most of the large volume of ponderosa pine killed by Elytroderma on the Ochoco National Forest in a recent outbreak was salvaged. Many cankered eastern hardwoods are salvaged annually for mine props and other uses. Heavily mistletoe-damaged ponderosa pine is often salvaged in the Southwest. On many of the larger forest properties in the Piedmont of the Southeast and in the northern half of Alabama, most of the timber cutting consists of salvaging littleleaf-diseased trees before they die.

There are many major gaps in our knowledge of disease behavior and control in connection with most of our more important diseases. New weapons in the fight against tree diseases comparable to the antibiotics in medicine, and DDT and other comparable insecticides in

entomology, are not available against forest diseases. Only research can lead to such new developments.

STATUS OF PROTECTION FROM INSECTS

Insects are among nature's most active agents in killing forest trees. To the extent that they sometimes thin young stands or kill decadent and suppressed trees their activity may be considered beneficial. But beyond this they injure useful trees and sometimes develop devastating epidemics. How to prevent or control insects, and utilize much of the vast amount of timber killed every year by insects are major forestry problems as yet largely unsolved.

Outright killing by insects may be endemic or epidemic in character. Every year a substantial amount of timber is killed as a result of endemic infestations by native forest insects. This mortality is normal to a forest and is unlikely to be materially reduced except by forest management practices which change the composition, age, or character of the stands. Periodically, insect epidemics occur, which kill large quantities of timber before they subside through natural causes or because of control. Bark beetles, by girdling trees and by introducing lethal fungi, are especially serious agents.

Next to killing trees the most important effect of insects on the timber resource is growth reduction. Cone and seed insects may deplete seed crops. Insects may wipe out young stands or seriously injure plantations. Twig and terminal insects may impair growth rates or ruin the form of trees and the quality of timber produced. Defoliators may devitalize trees and cause a serious reduction in growth rate and loss of productivity. The reduction in growth and quality caused by insects constitutes damage to timber nearly as great as the total amount of insect-killed timber. Insects also destroy usable wood by boring into the sapwood or heartwood and by introducing stains and decay which result in cull and degrade.

Since 1900 many major forest insect outbreaks have killed timber over vast areas. Six of the larger recorded outbreaks of catastrophic proportions are shown in table 22. These accounted for over 52 billion board feet of softwood timber. An additional 12 billion board feet of timber are known to have been killed during this period in other outbreaks of lesser size, and probably twice this much has been killed in small outbreaks which were not recorded.

The Impact of Damaging Insects on Timber Growth

Insects killed more timber than any other agency in 1952. They were responsible for 28 percent of the growing stock mortality and 10 percent of the national growth loss that year. The total growth impact to growing stock was 16 percent of the total from all destructive agencies, or 1,778 million cubic feet (table 1). Growth impact on sawtimber was 8,617 million board feet, 20 percent of the national growth impact.

Sectionally, the West led in growth impact from insects with 55 percent of the total insect losses to growing stock and 65 percent of the

sawtimber losses for all regions (table 2). The North and South suffered almost equally from insects.

Unlike the losses from all other agencies except weather, the mortality from insects exceeded the growth loss from insects for the country as a whole. This was due to the heavy mortality in the West. In the North and the South growth loss exceeded mortality from insects by five and two times, respectively (table 18).

Important Timber Losses Caused by Many Types of Insects

Bark beetles, the most important single group of forest insects, killed $4\frac{1}{2}$ billion board feet of sawtimber in 1952, accounting for 90 percent of the insect-caused mortality of sawtimber and 63 percent of the growth impact (table 19). In the West bark beetles attack mostly mature and overmature timber. Nationally, their damage is measured largely in terms of mortality rather than growth loss; 84 percent of their damage was mortality in 1952, with only 16 percent reduction in timber growth.

The western pine beetle, during a 25-year period from 1921 to 1945, is estimated to have killed 25 billion board feet. The mountain pine beetle decimated lodgepole pine stands for hundreds of miles along the Continental Divide in Idaho and Montana between 1911 and 1935. The amount of timber killed has been estimated at between 15 and 25 billion board feet. The mountain pine beetle is also estimated to have killed 10 billion board feet of ponderosa pine, western white pine, and sugar pine during the period 1910 to 1950.

One of the most spectacular insect outbreaks was that of the Engelmann spruce beetle which destroyed all of the spruce and some lodgepole pine over hundreds of square miles of western Colorado between 1940 and 1951. The total timber destroyed approaches 5 billion board feet, very little of which was salvaged. Starting in 1950, a new outbreak of this beetle threatens to kill all of the mature spruce on seven national forests in Idaho and Montana.

Another recent major outbreak is that of the Douglas-fir beetle. Following a serious blowdown in western Oregon and Washington, this insect is estimated to have killed an additional 3 billion board feet of Douglas-fir. Currently, epidemics of this beetle are prevalent throughout the range of Douglas-fir and are estimated to have killed over 2 billion board feet in 1952 alone.

Some other important bark beetles of the West are the fir engraver and pine engraver beetles; of the South, the southern pine, turpentine, and ips engraver beetles; and of the North, the eastern spruce beetle.

Defoliators were second to bark beetles in the amount of damage caused by insects in 1952. They accounted for 17 percent of the impact on growing stock and 15 percent of the impact on sawtimber. Defoliating insects reduce the growth rate of trees by destroying the foliage. Prolonged and severe defoliation of conifers often results in the killing of large numbers of trees. In general, hardwoods can stand more defoliation than conifers, and even several defoliations may not

Table 18.--Mortality from insects compared with growth loss, by section, 1952
(United States and Coastal Alaska)

GROWING STOCK

Section	Mortality	Growth loss	Growth impact
	Million cu. ft.	Million cu. ft.	Million cu. ft.
North	65	333	398
South	112	251	363
West	796	180	976
Coastal Alaska	27	14	41
Total U.S. and Coastal Alaska	1,000	778	1,778

SAWTIMBER

Section	Mortality	Growth loss	Growth impact
	Million bd. ft.	Million bd. ft.	Million bd. ft.
North	99	1,315	1,414
South	412	1,049	1,461
West	4,432	1,137	5,569
Coastal Alaska	98	75	173
Total U.S. and Coastal Alaska	5,041	3,576	8,617

Table 19.--Growth impact of damage by major insects on commercial forest land, during 1952 by section (United States and Coastal Alaska)

Insect	Growth impact to growing stock					Growth impact to sawtimber					
	North	South	West	Coastal Alaska	Total, U.S. and Coastal Alaska	North	South	West	Coastal Alaska	Total, U.S. and Coastal Alaska	Percent of total impact
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	
Bark beetles:											
Fir beetles	..	..	537	..	537	..	..	3,148	..	3,148	36.5
Pine beetles	..	101	224	..	325	..	434	1,238	..	1,672	19.4
Spruce beetles	6	..	97	..	103	28	..	524	..	552	6.4
Other	..	..	7	..	7	2	1	40	..	43	.5
Defoliators:											
Spruce budworm	1	..	53	..	54	2	..	290	..	292	3.4
Other	190	33	13	12	248	768	119	64	62	1,013	11.8
Miscellaneous 1/	201	229	45	29	504	614	907	265	111	1,897	22.0
Total, all insects	398	363	976	41	1,778	1,414	1,461	5,569	173	8,617	100.0

1/ Includes such insects as hardwood borers, white pine weevil, tip moths, cone and seed insects, spittlebugs, and aphids.

result in substantial tree killing. Thus, 98 percent of the total growth impact on sawtimber from defoliation was due to loss of growth, with the remaining 2 percent tree mortality.

Damage by defoliators in killing trees and in reducing growth is done by a few well-known species and a large number of miscellaneous insects. The spruce budworm has been especially damaging. Widely distributed through the true fir and spruce forests of this country and in Canada, it has periodically caused heavy defoliation over a period of years with resultant mortality and loss of growth. The spruce budworm outbreaks in New England and the Lake States between 1910 and 1926 killed about 14 billion board feet of balsam fir and spruce timber. In 1952, epidemics were in progress in New England, throughout the Rocky Mountain States, and in the Pacific Northwest. The budworm's 1952 growth impact is estimated at 54 million cubic feet of growing stock including 292 million board feet of sawtimber.

The gypsy moth is an introduced insect which has been a pest in the woodlands of New England for many years. Oak is particularly hard hit by the gypsy moth, and during outbreaks, hundreds of thousands of acres of oak woodlands may be defoliated in a single season. Due in part to an average annual expenditure of $1,893,000 a year for the past 20 years by the States and Federal Government, defoliations by the gypsy moth have been limited. The total growth impact for 1952 is estimated at only 16.3 million cubic feet of growing stock.

Tent caterpillars kill very few trees but their feeding results in a considerable reduction in growth. For 1952, this loss was estimated at 170 million cubic feet of growing stock, including 743 million board feet of sawtimber. Additional important defoliators which had a substantial effect on growth in 1952 include pine sawflies, larch sawflies, the hemlock looper, and the fir looper.

Miscellaneous insects, as a category in table 19 include: Hardwood borers, white pine weevil, pine tip moths, turpentine borer, cone and seed insects, Saratoga spittlebug, and the balsam woolly aphid.

A New Age in Insect Control

Surveys Are Basic to Detection and Control

Surveys to appraise the importance and distribution of many forest insects have been developed through the years. However, it was not until passage of the Forest Pest Control Act by Congress in 1947 that forest insect surveys were made possible on a nationwide basis. Under this Act surveys reaching into all of the forested regions of the country have been initiated. These are designed to help detect serious insect and disease outbreaks, and to appraise their magnitude and trends, so that prompt control measures can be taken.

Appropriations have been made available under the Act for forest insect and disease surveys on Federal forest lands and for cooperation with the States and private timber owners in expanding survey coverage

to all ownerships. The detection of outbreaks is recognized as the primary responsibility of the landowner, while such technical supervision and guidance as may be needed is usually furnished by Federal leadership. When Federal financial aid is requested for control, the Forest Service appraises the extent and importance of insect and disease outbreaks that are deemed serious enough to warrant control action, and estimates the cost of control. The Service provides technical supervision for control projects involving Federal participation and checks the results of control. The cooperative program is supplemented by assistance on the detection phase by other Federal landmanaging agencies and the State forestry services in addition to the private timber owners mentioned above. Surveys were run in 1952 for detection, appraisal, and control purposes, in connection with many insect outbreaks, among the more important of which were the Douglas-fir, Engelmann spruce, western pine, and southern pine beetles, the spruce budworm, and the larch sawfly.

The importance of detection surveys in a program of protection from insect outbreaks has been recognized by States and private timber owners, and in many parts of the country forest pest control action councils have been organized to encourage adequate surveys and the participation of private timber owners in control work.

Most Major Insects Now Combatted by Direct Measures

The protection of timber resources from forest insects can be accomplished either by the prevention of outbreaks, their direct control, or the reduction of losses through a program of salvage and utilization. During the past 10 years many new materials and methods for killing destructive forest insect pests have been developed. For the control of certain bark beetles penetrating oil sprays have been used successfully on large-scale control projects which would previously have been too costly to undertake. Aerial spraying and new insecticides such as DDT, developed during World War II, have made possible the effective control of defoliators over large areas at low cost. Following DDT came other new synthetic insecticides which have proven effective in the control of many forest insects. Recently, the direct control of forest insects through aerial sprays or the application of insecticides to the bark of infested trees has reached considerable magnitude and effectiveness.

Destruction of beetle populations through burning or spraying bark has been at least temporarily effective in many cases. Epidemics are also often controlled by some natural factor, or come to a halt through the depletion of susceptible host material.

The emergency and temporary character of most direct control is well recognized and efforts are being directed towards developing effective biological control and in managing forest stands so as to make them more resistant to insect attacks. Unfortunately, the development of satisfactory control methods of these kinds is very slow. Meanwhile, it will often be necessary to continue with direct control methods to prevent excessive losses.

At the present time the forestry agencies in many areas of the country are organized on an acceptable basis for handling direct control programs. In 1952 Federal funds helped finance a major share of the cost of 12 large insect control operations and many smaller insect and disease projects throughout the country. On at least four of the large operations, State and private funds were raised to share in the project costs. The other projects were wholly on national forest or national park lands, in which cases the full cost was met by the Federal Government. The Forest Service furnished plans and technical supervision but the projects were administered by the landmanaging agency most concerned.

In cases where substantial acreages of private or State lands were involved, control was carried out under the cooperative provisions of the Forest Pest Control Act and complementary State forest pest control laws. Most of the States having substantial amounts of forest lands have passed some sort of enabling legislation authorizing appropriate State officers such as the State forester, to control forest pests. In general, authority is granted to declare forest pests a public nuisance and require landowners to dispose of such pests either by themselves or with the available help of State and Federal authorities.

Where the Federal Forest Pest Control Act applies, the Federal Government can pay a part of the cost of control, usually not more than 25 percent, on State and private lands. Where control work on private land is done in accordance with State authority the costs may be met in part by State funds. The Act is not mandatory or regulatory in character. It has been of great help in bringing about more unified methods and coordinated joint action into control programs.

Forest insect control expenditures in 1952 by State, private and Federal agencies totaled $3,595,500 (table 20). Gypsy moth control expenditures were nearly half of this total. Most of the remaining expenditures were made for the control of the spruce budworm, Engelmann spruce beetle, and pine beetles in the West and South.

Biological Control--A New Tool Against Forest Insects

Efforts have been made to hasten forest insect control through artificial propagation of their natural enemies. In the case of introduced pests, such as the gypsy moth, conspicuous success has followed the introduction of its natural parasites. Recently, effective control of the imported pine sawfly has been obtained by ground and aerial spraying with an insect virus disease.

Insect Control Through Silvicultural Modifications

Another promising method of controlling native forest insects is through silvicultural techniques or forest management practices. By modifying the stand so as to make conditions unsuitable for insect attack, some insect damage can be prevented.

Studies of the spruce budworm in balsam fir stands have indicated that losses are most serious in mature and overmature stands, and where a high percentage of balsam fir occurs. This suggests that losses might

Table 20.--Expenditures for direct control of forest insects, 1952 (Continental United States)

Insect and section	State and private	Federal	Total
	Dollars	Dollars	Dollars
Pine beetle:			
South	51,900	97,700	149,600
West	37,700	136,600	174,300
Engelmann spruce beetle:			
West	5,000	691,100	696,100
Spruce budworm:			
West	147,000	594,600	741,600
Gypsy moth:			
North	972,000	800,000	1,772,000
Other defoliators:			
North	1,900	11,600	13,500
South	13,000	3,100	16,100
West	800	4,200	5,000
Miscellaneous:			
North	..	100	100
South	18,000	5,500	23,500
West	..	3,700	3,700
Total	1,247,300	2,348,200	3,595,500

be reduced by operating balsam fir stands on a shorter cutting cycle and by reducing the percentage of balsam in mixed stands. Attacks of young white pines by the white pine weevil appear to be less serious where the tree is grown in dense stands for the first 20 years or so, or in mixtures with hardwoods, particularly where the pines are partially suppressed by hardwoods.

Some bark beetle outbreaks have developed as a result of abundant host material provided by fires, windfalls, slashings, and drought. To the extent that these conditions can be controlled, or the weakened and killed timber promptly salvaged, beetle losses can be dminished.

Among the bark beetles, control through forest management has only been developed satisfactorily for the western pine beetle and the Jeffrey pine beetle in the interior ponderosa pine type. It has been amply demonstrated that cutting and removing trees with the highest beetle risk, usually from 15 to 25 percent of the stand, will effectively control these beetles for periods up to 15 years, even though neighboring stands remain infested. This method of prevention or indirect control has entirely supplanted direct methods of controlling these beetles on commercial forest lands where logging is feasible.

There is much need for research to develop forest management practices which will reduce or control damage by insects. So far, only the first steps into this broad field of control through modified silviculture have been taken. There will still be a need for direct or biological measures of control for those destructive forest insect species which do not depend upon adverse forest conditions for the success of their outbreaks. Recent trends have been away from sole reliance on direct control methods, and toward giving greater emphasis to biological and silvicultural control techniques.

So much remains unknown concerning the habits of forest insects, the factors governing outbreaks and their duration, and methods of control that progress is closely related to the research effort in forest entomology.

Opportunities For Salvaging Insect-killed Timber Improving

The present nationwide estimates show that over 5 billion board feet of timber was killed by insects in 1952. This timber mortality is made up of two components: First, the yearly endemic loss that is more or less evenly distributed throughout our entire forest area. This comprises probably two-thirds of the total, or 3.3 billion board feet. Second, the epidemic losses, which are more or less concentrated, comprise the remaining one-third or about 1.7 billion board feet. Much of the latter, at least, could be salvaged for commercial use.

As a result of large volumes of insect-killed timber, such as followed the Engelmann spruce beetle's devastation of 5 billion board feet of spruce in western Colorado; the threat of a similar catastrophe in Idaho and Montana; the blowdown and bark beetle kill of 12 billion board feet of Douglas-fir in Oregon and Washington; and another 3.7 billion of recently killed Douglas-fir in the Northern Rocky Mountain

region, a high percent of the present mill capacity in these areas is now operating on insect-killed timber but is yet able to utilize only a small part of the total.

In many parts of the country lumber companies are now gearing their operations to selvaging insect-killed timber. Added access roads are needed to make this large amount of salvable timber more readily available and in some cases added mill capacity is needed to take care of the large amount of material available.

THE IMPACT OF ANIMAL DAMAGE ON TIMBER GROWTH

Many kinds of wildlife, as well as domestic cattle, sheep, and hogs, damage timber. The combined effect of these animals and birds can be the limiting factor in successful regeneration of some timber stands. In almost all cases where animals have caused important damage to timber this resulted from excessively dense populations.

The total growth impact as a result of damage by animals on commercial forest land in 1952 is estimated to be 1,009 million cubic feet in growing stock including 2,722 million board feet in sawtimber (table 1), making animal damage responsible for 9 percent of the total impact to growing stock, and 6 percent of the impact to sawtimber. Only a small percentage of this loss is direct tree mortality. Approximately 93 percent of it results from unsatisfactory reproduction and inhibited growth due to animal damage (fig. 2). Animal damage is most common and important in the North where it is estimated that 86 percent of the animal impact on growing stock and 90 percent of the impact on sawtimber occurred (table 21).

Many Kinds of Animals Impede Growth and Regeneration

The extent of damage to timber by livestock varies greatly in different parts of the country. In the Southwest the loss of forest values caused by the grazing of domestic animals, partially from browsing of seedlings but primarily from site deterioration on overgrazed lands, is a serious problem in some localities. In many parts of the South timber damage due to browsing by livestock is common. Such damage also occurs through the use of farm woodlots by dairy cattle, particularly in the North. Livestock in some areas have not only injured and destroyed many young trees by browsing and trampling but excessive use has accelerated erosion, resulting in lowered site quality through loss of soil, increased soil temperatures, and more rapid losses of soil moisture.

In the South hogs have prevented thousands of acres of longleaf pine land from adequately restocking naturally to longleaf pine. Seedlings are subjected to severe damage beginning in their second year. Hogs persistently root up and eat the roots of seedlings, destroying reproduction both of planted and natural stock.

Big-game damage is caused primarily by deer, but there are a few limited areas, principally in the West, where elk and moose have caused considerable damage to aspen reproduction and conifers through

Table 21.--Growth impact of damage by animals and weather on commercial forest land during 1952, by section (United States and Coastal Alaska)

GROWING STOCK

Cause	Section of the U.S.			Total, U. S.	Coastal Alaska	Total, U.S. and Coastal Alaska
	North	South	West			
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
Weather	245	149	540	934	23	957
Animals	869	39	101	1,009	..	1,009
Miscellaneous 1/	401	223	105	729	..	729
Total	1,515	411	746	2,672	23	2,695

SAWTIMBER

Cause	North	South	West	Total, U. S.	Coastal Alaska	Total, U.S. and Coastal Alaska
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Weather	597	575	2,609	3,781	88	3,869
Animals	2,451	87	184	2,722	..	2,722
Miscellaneous 1/	505	558	295	1,358	..	1,358
Total	3,553	1,220	3,088	7,861	88	7,949

1/ Types of damage not ascribed directly to causes listed include suppression.

excessive browsing. Forest damage by deer occurs principally in the Lake States, the Middle and North Atlantic States, and in the Rocky Mountains. It is ordinarily greatest in the North during the winter months when deer herds are confined by snow to comparatively small areas. However, in some areas with excessively high deer populations, summer range has also been affected. Deer sometimes interfere with the establishment of forest reproduction by browsing the terminal shoots and side branches. Less common is the damage caused by big game animals through bark peeling and antler rubbing. Continued heavy browsing can result in deterioration of timber stands through the elimination of the more palatable species and dominance of species that are less palatable. An example is the transition from maple and ash to blue beech, ironwood, and beech in many areas in the Middle Atlantic States.

Damage to timber by bears has been observed mainly in the Olympic Peninsula area of western Washington, in western Oregon, and in California. Bears damage or kill young timber during spring and early summer by stripping bark and eating the succulent cambium layer. It has been estimated that one lumber company in California has recently been suffering bear damage of 700 to 900 board feet per acre per year over an area of 53,000 acres. Damage tends to be concentrated in small areas and is serious only in second-growth stands.

Rabbit damage to commercial forest stands occurs mainly in the Lake States, New England and in the Pacific Northwest, and results from the destruction of reproduction by browsing the entire plant in the case of seedlings, and by clipping shoots or girdling the main stems of reproduction. In more advanced reproduction, girdling and repeated clipping may retard stand establishment and result in forked stems and bushy trees. Where rabbits are numerous they are a serious threat to the success of Douglas-fir and pine plantations in the Pacific Northwest and in California.

Porcupine damage occurs mainly in the West and the North, and mostly in the winter months when porcupines obtain their food chiefly by feeding on the inner bark and cambium layer of young pines and northern hardwoods. They girdle stems of small trees near the ground, but on larger trees they feed in the upper portion of the bole. The principal damage consists of partial or complete girdling of the trunk and branches. Although few trees are killed outright growth is reduced and many are deformed or weakened and made susceptible to insect and disease attack.

The killing of trees for food by beaver occurs throughout the range of this animal. However, this damage and the flooding of stands are usually limited to small areas and are not important factors in timber management.

Forest tree seeds, particularly of conifers, are important food for many small mammals and birds, and the impact on establishment of tree reproduction can be severe. The most widespread and important of the seed-eating mammals are the white-footed mice, tree squirrels, and chipmunks, but there are many others. Many species of birds also feed on tree seeds.

Tree squirrels cause damage not only by consuming seeds but also by cone cutting, often before seed maturity. Tree squirrels are particularly heavy consumers of coniferous seeds under natural conditions, and have been known to take as high as 70 to 75 percent of the seed crop in some areas.

White-footed mice, because of their fondness for tree seed, their wide distribution, and high reproductive capacity, are sometimes the most important single factor limiting successful forest regeneration, particularly in the Pacific Northwest. Favorable habitat conditions for these mice are created as a result of fire and slash burning. The new vegetation appearing on such areas provides abundant food and results in a buildup of the mouse populations. The increased animal pressure often leaves little opportunity for successful natural or artificial seeding. It has been estimated that a rodent population of 24 deer mice and one or two chipmunks per acre will destroy not less than 80 percent of any coniferous seed sown before it can germinate.

Animal Damage Can Be Controlled

The only feasible means of reducing and controlling forest damage by livestock and big game is through good range practices and game management. The use of forest types by these animals is not incompatible with timber production provided the animals are managed on the basis of proper utilization of key forage plants. Control of forest damage by game and livestock requires the establishment of specific carrying-capacity standards in a multiple use forest program.

Proper big game management requires that game numbers be maintained at levels which should considerably reduce conflicts between game and forests. Thus, in areas where game animals are damaging their habitat, hunting seasons should be liberalized and the harvest of surplus animals by sport shooting encouraged in order to maintain desirable numbers. Proper multiple use forest management also often requires that silvicultural practices be modified to maintain desirable game habitats. In most areas where game problems have developed, progress is being made toward obtaining proper livestock and big game herd management.

Direct control methods that have been used to prevent animal damage to forests include fencing, trapping, snaring, shooting, and the use of poisons and repellents. Although fencing can be used in small areas to control a number of animals that damage forest tree crops, the high cost is seldom justified. It is sometimes practical to control domestic livestock by fencing where high value tree crops or plantations are involved.

Control of small rodents is extremely difficult, largely because small mammal populations recover so rapidly after being reduced by control measures. Poisons have been effective on small areas, but the costs are high. Trapping on large areas is not practical. Moreover, recent studies indicate that certain seed-eating rodents, particularly deer mice, consume large numbers of certain insect enemies of forest trees. Recent developments in the use of repellents in treating seeds seem to offer real promise for control of small rodent damage to plantations.

The porcupine's conspicuousness, slow gait, and dependence on quills for protection makes control by clubbing or shooting easy, and systematic hunting as a control project is justified where porcupine concentrations are heavy or especially valuable stands are being damaged. Other porcupine control methods that have been used with varying success include trapping, poisoning with strychnine baits, and fencing.

Snowshoe hare control through reduction in numbers is not often practical except in small areas. Other methods to prevent damage must be sought where large areas are involved. Effective repellents have been devised which are practical to apply to nursery seedlings prior to planting in hare habitats but will protect them only until new growth develops.

Beaver can be effectively controlled by trapping. Most States have rigid control on beaver trapping and the removal of beaver that are doing damage is done by State employees or licensed trappers. The obvious method for control of deer, bear, and other big game animal populations that have grown to a point where they are causing damage to their food supply is through liberalized hunting seasons.

Records available on direct expenditures for the control of animal damage in 1952 indicate that less than $100,000 was spent for this purpose. This was mostly for hog control in the South and rodent and bear control in the West.

WEATHER EFFECTS DESTRUCTIVE TO TIMBER

The damage to timber from rigorous weather effects in 1952 amounted to 957 million cubic feet of growing stock, including 3,869 million board feet of sawtimber, or 9 percent of the total national growth impact from all sources (table 1). This loss, like the fire loss, varies considerably from year to year, especially in certain regions. Most of it (88 percent) was outright mortality, with a minor fraction attributed to growth loss (table 1 and fig. 2). The West suffered a 1952 loss, primarily from storm damage, that far exceeded the losses from similar causes in the North and South combined (table 21).

Weather factors are tremendously important causes of loss in certain regions and minor in others. Thus, in the Pacific Northwest, where some of the great historical blowdowns have occurred, mortality from storms exceeded that from any other cause, making up 40 percent of the regional mortality in 1952. In this region alone 1,613 million board feet of timber was lost, largely from wind. In the Northern Rocky Mountain region wind caused mortality that was exceeded only by insects. Wind is periodically important in all of the western regions. It prostrates trees over great acreages, blows down root-rotted trees, and sets the stage for insect attacks and fire.

Hurricane winds are frequent in much of the South, and in recent years have occasionally been damaging throughout all of the States bordering the Atlantic Ocean. Tornadic winds are an annual occurrence in the South, but unlike hurricanes, they usually cause damage in only a very narrow path. Ice, frost, hail, and snow damage cause periodic losses

in the West, in the entire North, and southward through the Appalachian Mountains. An important damaging after-effect of ice storms is the heart rot that develops as a result of limb and top breakage.

Lightning causes notable damage in many regions and is probably worse in the Southern Rocky Mountain region than anywhere else in the country. The loss of individual trees by lightning strikes is minor compared to the fires and bark beetle infestations that so often follow. Lightning also exposes trees to attack by oak wilt and other diseases.

Drought causes important losses periodically in most regions, with California, the Southern Rockies, the Plains, and the South suffering the most frequently. For example, pine plantations were damaged extensively during the 1952 drought in the South. When the full effects of droughts are known, the damages ascribed to them may be increased. Some maladies of unknown cause such as birch dieback and sweetgum blight, and attacks by some insects such as the southern pine beetle, may prove to be brought about primarily by drought. Other weather-induced losses are caused by rock and snow slides, hot winds in the West, and by a variety of other disturbances.

There are some opportunities for reducing losses from weather damage. Harvest cuts can be regulated to leave sufficient trees properly spaced and in patterns that help reduce blowdown, and logging steep areas can be minimized to avoid snowslides and earth slides following heavy rains. Forest composition can also be regulated toward more wind- or ice-resistant species. The reduction of loss following damage from extreme weather conditions is, however, largely a matter of salvage.

Salvage of Storm-damaged Timber

Where weather damage is sporadic and light, there is little opportunity for salvage unless the killed timber is readily accessible to current logging operations or the area is under intensive management. Where weather-damaged timber is concentrated, and of high value, there is usually a greater opportunity for salvage, provided prompt plans are made to shift logging operations into the damaged timber and to build such access roads as are needed before the timber values decline.

Recent wind damage in the West has been in rugged timbered areas requiring a large investment for access roads. For example, in the case of the windstorm of 1949 which blew down 365 million board feet of timber in the Northern Rocky Mountain region, an appropriation of $9,000,000 was obtained in 1953 to build roads into the damaged national forest lands.

An even larger road construction program to salvage windthrown and insect-killed timber on public lands in the Pacific Northwest has been found necessary by both private and public agencies. In general, most private land in the West is more accessible than the public forest land that includes vast inaccessible areas where millions of board feet of killed timber go to waste annually because of lack of roads. A greatly stimulated access road program is needed for these areas.

In the North and South, accessibility is good enough to make major salvage operations generally feasible. In the New England hurricane of 1938, almost half of the timber killed was salvaged. Salvage from storm damage usually requires quick opportunities for use of the wood, ready access, and mill facilities to handle unexpectedly large quantities of killed timber.

CATASTROPHIC TIMBER DESTRUCTION SINCE 1900

Every so often, the timber destroyed by fire, insects, disease, or wind is so great that the event is considered a catastrophe. For the purpose of this Timber Resource Review, a catastrophe is defined as an unpredictable event characterized by a combination of unusual severity and concentrated loss in both time and area and of sufficient magnitude to cause major dislocation of forest management or timber utilization in a given region. Although the loss is usually suffered in a period of less than a year, it may extend over more than a year in the case of insect and disease attack. The Tillamook burn of 1933, the New England hurricane of 1938, the Engelmann spruce beetle destruction of timber in Colorado between 1940 and 1951, and the chestnut blight are examples of the sort of events included in this category.

The timber losses resulting from catastrophes which have occurred since 1900, and which met the requirements of the definition are listed in table 22. They exceeded 122 billion board feet, of which approximately 16 billion were salvaged. Insects caused the greatest loss, exceeding 52 billion board feet. Fire caused nearly 32 billion board feet of loss; wind over 19 billion and disease 18 billion board feet.

In estimating our capacity to meet future timber needs allowance must be made not only for the largely expected or reasonably predictable losses from destructive forces, as typified by the current losses presented in table 1, but also for the unpredictable catastrophic losses that will undoubtedly occur at intervals in the future. The net timber loss from these events is estimated to average about 2 billion board feet a year.

The West, with a catastrophic loss of 79 billion board feet (table 23) had 75 percent and the East 25 percent of the total catastrophic loss. This difference is probably due mainly to the larger volumes of timber per acre in the West and the more extensive areas of virgin forest which are particularly susceptible to insect attack, wind, and fire.

Three memorable fires of catastrophic proportions are listed. These are the Yacolt fires of 1902, the Idaho-Montana fires of 1910, and the Tillamook burn of 1933. The famous Cloquet fire of 1918 in Minnesota was not included because this burned largely on cutover land and hence did not kill a volume of timber comparable to the others.

Due to the concentration of volume of timber killed in area and in time, 21 percent of the timber killed in the three catastrophic fires was salvaged. With the more recent burns, the percentage of salvage has greatly increased due to better equipment and accessibility and this trend towards greater utilization should continue.

Table 22.--Catastrophic timber destruction since 1900

(Continental United States)

Major cause	States	Years involved	Approximate volume killed	Approximate volume salvaged	Percent of killed volume salvaged
			Million bd. ft.	Million bd. ft.	
Insects:					
Spruce budworm	New England	1910-19	8,000	900	..
Spruce budworm	Lake States	1913-26	5,800	(1/)	..
Mountain pine beetle	Idaho-Montana	1911-35	15,000	50	..
Western pine beetle	Oregon	1921-37	12,000	(1/)	..
Western pine beetle	California	1931-37	6,000	(1/)	..
Engelmann spruce beetle	Colorado	1940-51	5,000	29	..
Total	..	..	52,400	979	2
Fire:					
Yacolt fires	Washington	1902	12,000	1,000	..
Idaho-Montana fires	Idaho-Montana	1910	8,000	800	..
Tillamook burn	Oregon	1933	11,830	2/5,000	..
Total	..	..	31,830	6,800	21
Wind:					
Olympic blowdown	Washington	1921	5,000	200	..
New England hurricane	New England	1938	2,650	1,250	..
Douglas-fir blowdown and bark beetle attack	Oregon-Washington	1949-52	12,000	2/1,000	..
Total	..	..	19,650	2,450	12
Disease:					
Chestnut blight	Northern	1912-24	13,396	5,063	..
Chestnut blight	Southern	1925-40	4,757	755	..
Total	..	..	18,153	5,818	32
Total, all causes	..	..	122,033	16,047	..

1/ Salvage nil or no estimate available.
2/ Salvage still in progress.

Table 23.—Catastrophic timber destruction by location and period since 1900 (Continental United States)

Location and approximate period	Approximate volume killed		Approximate volume salvaged	
	Million bd. ft.	Percent of total	Million bd. ft.	Percent of killed volume
East:				
First (1900-25)	27,196	22	5,963	22
Second (1926-52)	7,407	6	2,005	27
Total	34,603	28	7,968	23
West:				
First (1900-25)	25,000	21	2,000	8
Second (1926-52)	62,430	51	6,079	10
Total	87,430	72	8,079	9
Total	122,033	..	16,047	13

Wind has also caused three major catastrophes in the last 52 years. The Olympic blowdown of 1921, the New England hurricane of 1938, and the Douglas-fir blowdown and bark beetle attack of 1949 to 1952 are well known to foresters. Most of the latter blowdown occurred in December, 1951. Loss from wind tends to be concentrated in respect to time and place, and as a consequence a high percentage of timber thus killed can often be salvaged. Very little of the Olympic blowdown of 1921 was salvaged because of inaccessibility and lack of equipment and markets at that time. Following the New England hurricane of 1938, salvage operations were organized by the Forest Service on an emergency basis and 47 percent of this loss was salvaged.

The recent heavy losses from wind and bark beetles in the Douglas-fir stands of western Oregon have brought about a determined effort on the part of all agencies, Federal, State, and private, to salvage a high percentage of this loss. One billion board feet has already been salvaged and the work is still in progress.

Catastrophic insect losses have been spread out over large areas and over periods of many years. As a consequence, the problem of salvage can become a gigantic one. Yet, only 2 percent of the timber destroyed in the catastrophic insect outbreaks cited in table 22 has been reported as salvaged. The opportunities for salvaging insect-killed timber are increasing considerably and progress is being made in meeting this problem.

The chestnut blight has killed the entire commercial stand of chestnut over a period of 50 years, extending down from New England and the Middle Atlantic Regions into the deep South. Because of the commercial value of the tree, its wide use, its accessibility, and durability, 32 percent of the killed chestnut volume was salvaged.

Fire and wind damage often bring about increased losses from insects and disease. For example, the recent Douglas-fir blowdown in Oregon of 10 billion board feet resulted in an additional 2 billion board feet of Douglas-fir timber killed by bark beetles. Also, these large areas of insect-killed and blowndown timber greatly increase the chance for a holocaust. Many of the more serious fires in Idaho and Montana have been in areas of early "bug-killed" timber.

Catastrophes by fire, insects, and disease should be largely preventable by early recognition and prompt control measures. Many epidemics such as those in today's unmanaged stands may be avoided by improved silviculture. Little can be done to prevent wind damage but prompt utilization of windthrown timber will do much to minimize this loss. If these various measures are taken, some of our largest timber losses can be avoided.

THE OUTLOOK FOR REDUCING TIMBER LOSSES

In this report it has been shown that a loss of 44 billion board feet of sawtimber will result from the destructive events of 1952. This loss is equivalent to 92 percent of the sawtimber growth or 90 percent of the cut in 1952. It is obvious, therefore, that the extent to which

such losses can be reduced will have a significant bearing on our future timber supply. While there is no fully satisfactory basis available for establishing longterm trends in growth impact for each type of destructive agency, it is possible to foresee general trends from study of the data presented and from knowledge of the manner in which fires, diseases, insects, and other factors operate.

If the annual acreage burned decreases as expected, timber losses will be proportionately reduced. Much of the early gain will be made on lands now unprotected that are poorly stocked and which have been burned repeatedly over the years. Nevertheless, the reduced impact of fire on our timber supply will be substantial. Table 24 shows the reductions in growth impact that are expected to be achieved by 1960. Losses due to 1952 fires and fires of the average year are contrasted with those expected in 1960. The estimated reduction for the Nation is 35 percent of the growth impact on growing stock for the recent average year. A large percentage reduction is expected for the North and West but the major gain will be in the South where, through improved fire control, timber damage should be reduced by more than 460 million cubic feet per year. Much of this gain will come from less basal wounding of hardwoods and reduced destruction of seedlings and saplings. The gains in the West will be primarily through reduction of coniferous sawtimber mortality.

The longer-term outlook, although less definite, is still encouraging. All signs point to fewer man-caused fires, and more intensive fire control, with corresponding reductions in burned area, all of which add up to less timber loss. Certain counteracting factors will operate against indefinite continuation of downward trends in fire losses. As growing stock increases and timber quality improves, the timber values subject to loss by fire will be greater. The tremendously increasing use of forests by the public, greater industrial development, more extensive logging, and similar changes will add to future forest fire risk and hazard.

Fire protection, under the present pattern, has made substantial progress in reducing losses from a great potential threat. Its continuation promises further gains. The Clarke-McNary Act of 1924 established the pattern under which these gains were accomplished. Similar opportunities to reduce losses from forest insects and diseases will result from the extension and intensification of the survey and control activities authorized by the Forest Pest Control Act of 1947. This Act authorizes the Secretary of Agriculture to provide for detection, appraisal, and control of insects and diseases on Federal forest lands and provides the basis for cooperating with State and private organizations in detecting and controlling pests on non-Federal lands.

The Forest Service regional experiment stations have been delegated responsibility to conduct insect and disease detection surveys on all forest lands for the purpose of locating abnormal occurrences of pests at early stages. Detection is developed primarily on a voluntary basis by the Forest Service among many State and industrial foresters and private landowners.

Table 24.--Estimated growth impact from fire on commercial forest land in 1960 compared to 1952 and the average year 1948-52 (Continental United States)

Section	Growth impact: 1952	Growth impact: Average year 1948-52	Estimated growth impact: 1960	Estimated growth impact: Reduction as percent of average
	Million cu. ft.	Million cu. ft.	Million cu. ft.	
North	193	92	44	52
South	1,378	1,477	1,015	31
West	115	235	119	49
Total, U. S.	1,686	1,804	1,178	35

The Forest Service technicians in the experiment stations follow up detection reports and make detailed appraisals of infestations on all lands. Recommendations on the technical feasibility and soundness of a control project are made in the appraisal report on the basis of the extent, activity, damage, and potential threat of the insect or disease and on the basis of knowledge of control methods. If the outbreak is on Federally-owned lands, the responsible local landmanager recommends for or against a control project after balancing costs against the extent to which losses can be prevented. The State forester performs this function if the insect or disease problem is on State or private lands.

All recommendations for control projects are considered and priorities are assigned for selected projects by the Chief of the Forest Service who also allots funds appropriated for control work. For projects on Federal lands, the administrative unit of the agency involved plans and conducts the control job with technical assistance from the experiment station personnel. Such jobs are financed entirely from Federal funds. State foresters usually take the lead in planning and conducting control projects on State and private lands but get assistance from industrial foresters and Forest Service technicians. Contribution of Federal funds in sharing the costs of control on State or private lands is flexible, depending upon circumstances and upon the nature of intermingled land ownership. Under the present policy, 25 percent and occasionally as much as one-third of the cost of a project on State or private lands may be contributed from Federal sources. During the control job, Forest Service entomologists and pathologists give technical guidance as needed to insure proper use of the best control techniques. They make inspections during control operations and conduct post-control surveys to evaluate the effectiveness of the work.

The entire pest control survey activity is relatively new but gives promise of being an effective system where control of losses dictates the need for direct attack upon forest pests.

In other directions there is no question but that progress, although slow, is being made in reducing losses from forest diseases. Since 73 percent of the 1952 sawtimber impact from disease was attributed to the heart rots, gains in reducing their losses would be particularly important. The outlook for major gains in this field is promising in view of anticipated reduction in fire-scarring and logging injury. together with the gradual dying and elimination of badly damaged and decadent timber by cutting, poisoning, or girdling.

Progress is being made in selection and breeding for resistance to blister rust, littleleaf, and other forest diseases. Blister rust control is becoming more efficient with new mechanical and chemical means of Ribes eradication, and oak wilt control methods have been simplified. Large-scale control against dwarf-mistletoe has only recently been started. A substantial reduction in disease mortality is expected in most regions during the next half century, provided no serious new killing diseases make important inroads on commercial species.

Although little data are available on which to base the future trends in timber losses from insects, several factors point to an improved situation. More than half of the loss from insects today is due to mortality in western sawtimber. However, the amount of insect-susceptible old growth is being steadily reduced and special cuttings to remove potential insect host trees are being extended. Future insect control through silvicultural practices will likely increase in effectiveness as we learn more about insect activities in relation to surrounding conditions. Control of stand composition to remove susceptible tree species, thinning to reduce density, and the development and use of insect-resistant strains of trees will all aid in reducing future insect losses.

The development of new insecticides to combat both defoliating insects and bark beetles, and new methods of application, have been outstanding in recent years. Continued improvement in both insecticides and methods of use is expected, with extension of better direct control practices to more kinds of insects. Methods of biological control against forest insects have not been fully explored and developed, but the spread of virus and other insect diseases by airplane holds great promise. Wider use of insects that prey on damaging insects is expected in the future.

Although the longterm outlook for the reduction of losses from diseases and insects is favorable, such progress will doubtless be gradual, tempered by some setbacks, and measured to a considerable degree by progress in research and in the implementation of coordinated and cooperative control efforts among State, Federal and private timberland owners.

Animal damage to timber should gradually lessen in the future, as a better understanding of animal problems, including animal management and control, is achieved. Wild hogs in the South are in steady decline, control of rodents is slowly improving, and better livestock management on woodland and forest range are expected to result in less timber loss. Big game animals, on the increase for many years, are being managed better in some parts of the country so as to balance herd size with available food. However, many factors will continue to influence intensive big game management so that reductions in timber damage due to deer especially will be difficult to achieve.

When the progress being made in the control of all destructive agencies is viewed in the aggregate and the results are contemplated, our future forests take on a definite pattern. Lessened damage by fire, diseases, insects, and other agencies will result in better stocking of many forest areas now sparsely stocked or bare. Gradually, the numbers of small trees in cordwood and sawtimber sizes will become more plentiful. Less basal wounding will result in reduced decay and fewer rotten cull trees will be present in our forests. Fewer dead and dying trees will be in evidence because of effective prevention of mortality and more complete salvage when losses occur. Thus, tomorrow's forests will present a different picture as we capture much of the 44 billion board feet of sawtimber which in 1952 we see as the impact from destructive agencies.

Regions and Sections used in the Timber Resource Review

TIMBER RESOURCE REVIEW

CHAPTER IV
FACTORS AFFECTING FUTURE SUPPLY AND QUALITY OF DOMESTIC TIMBER

B. CONDITION OF RECENTLY CUTOVER LANDS

(Preliminary Review Draft Subject To Revision)

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INDEX TO TIMBER RESOURCE REVIEW REPORTS AND APPENDIX MATERIAL

(Each Chapter and each Section, in the case of Chapters IV and IX, is a separate document)

CHAPTER IV. F A C T O R S A F F E C T I N G F U T U R E S U P P L Y A N D Q U A L I T Y O F D O M E S T I C T I M B E R

B. CONDITION OF RECENTLY CUTOVER LANDS

(Preliminary review draft subject to revision)

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September, 1955

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CONDITION OF RECENTLY CUTOVER LANDS

INTRODUCTION

The current and future growth in volume of forests is greatly influenced by certain conditions of forest stands after cutting. These conditions can result in maintenance of precutting growth or even an increase of growth. They can also result in growth at very low volumes for many years after cutting. The quality or usefulness of the growth is similarly affected by these conditions.

It is estimated that from 2 to 4 percent or from 10 million acres to 20 million acres of our commercial forest lands are cutover each year to supply the national market for wood products. Already over half of our annual timber cut is derived from stands previously cutover. In 1952, 26.3 billion board feet of sawtimber or 54 percent of the national total sawtimber cut was derived from commercial lands of the North and South combined. The cut of growing stock from these sections was 7.0 billion cubic feet or 65.4 percent of the national total. Since almost no virgin timber remains in these sections a very significant portion of the annual timber cut is thus being supplied from areas cutover at least once. In addition to the sizeable portion of our annual supplies derived from eastern areas already cutover, second growth in parts of the West is being cut for timber products. Stands of young-growth sawtimber, poletimber, seedlings and saplings and non-stocked areas now make up 61 percent of all western commercial forest lands. About 70 percent of the sawtimber inventory of all regions is found on commercial forest lands of the West and Coastal Alaska, a substantial portion of this volume being in old-growth stands.

As cutting in these old-growth areas proceeds their volume and area will be reduced with the result that even higher proportions of our annual needs for wood must be found on areas previously cutover. Eventually all forest products will necessarily come from timber grown on such areas. Thus the productive condition of cutover lands has an important bearing upon future supplies and the capacity of these areas to supply wood requirements in the years ahead.

The condition of cutover lands is only one of several important factors affecting current and future growth of domestic timber. Other important ones such as protection and planting are covered as separate portions of Chapter IV. Reference to still others is found elsewhere.

The term "recently cutover lands" as used in this report refers to those commercial forest areas from which trees were removed for the manufacture of forest products during the period January 1, 1947 to the date of field examination in 1953 or 1954. Excluded from the survey were those areas where cutting was part of a conversion from forest to other use, where cutting was done on noncommercial forest land and where cutting was incidental to home use on small properties or to construction of roads, bridges, administrative sites and similar developments on larger private or public forests.

The specific information obtained in the survey and reported on here includes:

1. A productivity classification of recently cutover lands by size and type of ownership, geographical location and forest type group.

2. Identification by ownership class, location, forest type group and specific condition of cutover area; those recently cut lands having adverse effects upon the national level of growth as compared with those which tend to maintain or increase this level.

3. Related material on residual stand-size class, type of primary products removed in recent cuttings by broad size classes and the results of an intensified survey on the West Coast.

This information leaves out of direct consideration many phases of forest management. For example the survey does not appraise the extent to which sustained yield policies have been adopted by forest owners. Methods of logging, types of improvements, degree of adherence to classifications of cutting practices or silvicultural methods were not measured. The amount of effort expended to attain a given forestry objective is not rated. Only as activity in these phases are reflected by the conditions found on the recently cutover lands examined do they influence results.

Previous Related Appraisals

Interest in the condition of cutover lands has been expressed since the beginning of conservation efforts in the United States. During early stages of forestry development some landowners and public agencies adopted policies of making cutover area surveys. For several decades a major effort of forest research has been to determine the effects of cutting methods on subsequent growth and to develop methods that would increase growth. There is a voluminous forestry literature, both technical and general, relating to cutover lands. However, for only little more than a decade have there been comprehensive efforts to appraise the condition of cutover lands over broad areas in terms of specific standards or criteria. Only one such effort, the "Forest Reappraisal" of 1946 has been on a national basis.

Surveys of this kind are described briefly below:

1. During 1942-1945 Louisiana State University conducted a survey in the loblolly-shortleaf pine type of Arkansas, Louisiana and Mississippi covering five sample areas typified by small to medium sized forest ownerships and published the results as Bulletin 393. This study developed standards which recognized the two elements of species composition and pine stocking. Classifications of these two elements were integrated into a pine stocking index. This index was considered indicative of productive capacity and was related to the number of owners and the total forest area in each ownership type and size class.

2. In 1945 the Forest Service began a comprehensive nationwide reappraisal of the forest situation, part of which was a survey of forest practices. Results of this survey were included in the publication "Forests and National Prosperity," United States Department of Agriculture Bulletin No. 668 of 1948. This was the first nationwide attempt to collect and interpret statistical material on forest practices. Cutting practice guides were developed for each major forest type as a median standard. This standard included the numbers of trees of various sizes and species groups needed after cutting to qualify for the median or "fair" cutting practice level. It placed considerable emphasis on the operable volume of timber left on the ground after cutting. However, alternatives to this were provided. Additional guides provided means for judging the degree of forestry effort expended on the ownership. Each ownership examined was then classified into one of five levels of practice. These ranged from "high order" to "destructive," with two of the five rating above the median "fair" level and two below. Differences between the standards for "fair" practice and the practices on a particular ownership both as to stand of timber left after cutting and degree of forestry effort on the cutover area and elsewhere on the ownership were observed and used as the basis for classification. The entire area of each property with cutting was considered as operating area. Operating area within each type or size class of ownership was distributed over the five cutting practice levels in summarizing the results.

3. In 1947 the Forest Service and the Mississippi Agricultural Experiment Station jointly studied the ownership and management of private forest lands in Central Mississippi. Technical Bulletin 23 of the Mississippi Agricultural Experiment Station contains the results. Forest management was rated on the basis of cutting practice and fire protection by six classes ranging from "excellent" to "destructive." Emphasis in the cutting practice phase was placed on the changes which cutting made in stocking and species composition. The level of management was related to size class and type of ownership both on the basis of acreage owned and number of owners.

4. The Northeast Pulpwood Research Center under auspices of the pulp industry studied cutting practices on private lands in New England, New York, and Pennsylvania in 1950-51 and published the "Forest Practice Survey Reports" in 1952. The five forest practice classifications used by the Forest Service a few years earlier were adapted with local modification in this study, but the method of relating the ratings to locality and type of ownership was based upon the volume removed under each practice level rather than area. This was the first of such studies to report the distribution of practice levels by forest types in addition to locality and ownership classification. Another innovation was the separation of results under intent of owners to practice forestry and results secured by accident.

5. Current cutting practices on both public and private forest lands in Michigan were studied in 1952 by Michigan State College and results published as Technical Bulletin 238 of that institution. Cuttings were classified into three grades and these were related to ownership group in proportion to the acreage held by each group. This study dealt with condition of forest stands before and after cutting and emphasized the effect of cutting on tree size and quality.

6. In 1953 the Tennessee Valley Authority conducted a study on the management of private lands in the Tennessee Valley. Management was classified into three groups, "Good to Excellent," "Fair," "Destructive to Poor." Qualification for one of these was based upon integration of nine rating elements. These were planning, volume cut control, silvicultural control, logging control, fire control, insect and disease control, grazing control, tree planting, and improvements. Relation to size class and type of ownership was based both on forest area and on number of owners. Results appeared in a Tennessee Valley Authority publication of 1954 entitled "Private Forest Management in the Tennessee Valley."

7. Also in 1953 the Southern Pulpwood Conservation Association began a sampling of pulpwood cuttings. These were confined to cutting by Association members on non-company lands and classified the type of cutting employed, i.e., clear-cut, land clearing, seed tree, partial cut, thinning, or salvage cutting. The volume of pulpwood removed under each type of cutting is used as the basis for weighting of summaries. This study is conducted annually.

Thus since 1942 seven related surveys have been conducted. The Federal Government, the States and the pulpwood industry have been responsible for two each with another sponsored jointly by Federal and State sources. The survey of recently cut lands, conducted as part of the Timber Resource Review is the eighth such effort in little more than a decade, but only the second on a national basis.

The brief summary of past related work shows wide variation in concepts. The basic elements recognized have ranged from the two used in the first such study by Louisiana State University to the nine element rating system of the Tennessee Valley Authority. Weighting of final results has included area, number of owners and volume concepts. Standards for classifications have ranged from descriptive definitions to specific numerical measures or combinations of these two. Some have placed major dependence on what people were doing in their woodlands by classifying practices. Other standards were based primarily on conditions actually observed in the field. Combinations of these two are common. Field work has varied from quick classification of general conditions as observed by trained workers to specific counts or tallies on sample plots. Despite these differences a feature common to all such studies is concern as to the contribution that cutover areas will make to future timber supplies.

Obviously concepts and methods are far from standardized and are going through developmental stages. The subject covers a large number of complex biological and other technical relations. Newness of these efforts and only partial development of forest science in the United States is responsible for variations in concepts and methods. They are also responsible in part for the contention that frequently accompanies such efforts. Standards have changed during the few years of effort on such surveys and will continue to change as new knowledge and new problems develop. Comparisons between surveys conducted at intervals to determine trends will not prove valid during this rapid stage of development. Each survey stands on its own merits as an expression of the concepts under which it was conducted.

Comparability of National Surveys

With two national surveys completed, one in 1945 and the other in 1953-54, comparisons between them to observe trends are probably inevitable. However, some major concepts basic to the two surveys differ so widely that comparisons between results are not valid and meaningful estimates of trends cannot be made.

Early during the period of review and formulation of plans for this phase of the Timber Resource Review the new concepts developed raised sharply the question of comparability with the forest practice survey of the 1945 Reappraisal. At this point the Forest Service had a choice of the following alternatives:

1. Adopt concepts substantially the same as those of the Reappraisal and thus preserve opportunity for comparisons, or

2. Sacrifice comparability for survey results based upon new concepts and changes in previous ones judged important because of advances in technical knowledge and recent experience.

The decision was made to adopt the second of these alternatives thus sacrificing comparability.

Probably the least invalid of several possible methods for determining trends is to compare the proportion of recently cut lands in the high productivity class of the current survey with the combined proportions of "high order," "good," and perhaps half of the "fair" practice levels of the Reappraisal. However, any statistics derived by this method will provide very questionable basis for comparisons of trends.

Major reasons for lack of comparability are: (a) differences in standards used to derive final classification of the land unit examined, (b) differences in concept of operating area which is used to derive final summaries of results and (c) differences in the number of classification levels used to express results. There are additional minor differences which in total add considerably

to the lack of comparability. In a following portion of this report which presents the basic concepts these differences will be explained in more detail.

How Concepts Were Developed

The first step in developing plans for the survey of recently cut-over lands was a conference with a working committee of the national advisory group to consider the scope of this survey. Following this a preliminary plan was developed by a Forest Service task group and released for review purposes in July of 1952. Comments and suggestions for revision of this preliminary plan were obtained as follows:

1. The plan was reviewed at local public meetings called by Regional Foresters of the Forest Service. Representatives were invited from industrial groups, the forest schools, labor, conservation associations and from Federal and State conservation agencies.

2. Later these local meetings culminated in a series of four larger conferences held at Atlanta, Ga., Philadelphia, Pa., Milwaukee, Wisc., and San Francisco, Calif. Here were summarized the results of the local meetings.

3. In addition a number of more limited local meetings and numerous conferences were held to obtain advice and suggestions on the preliminary rating standards or criteria for each forest type. Foresters from public agencies and from industry participated in this phase.

4. The minutes of meetings, resolutions and briefs filed by organized groups and other sources of comment were carefully analyzed as a basis for revision of preliminary plans and criteria.

The analysis of comments revealed many constructive suggestions and also showed opposing views on many important phases. Revision of the plan, including trial runs in the field, required nearly a year and a greatly revised plan was again released for review in July 1953.

Reaction to this revised plan showed that progress had been made in reducing differences in viewpoints but that many divergent areas were not yet reconciled. Some thought that the standards for judging productivity would result in overly optimistic results--others expressed opposite opinion. The new basic procedure for rating productivity on recently cut land was challenged by some while others felt that although new, it was sufficiently well developed, and was an improvement over other preceding methods and satisfactory for application. Questions were raised regarding the standards and procedures which differed to such an extent from those of preceding related surveys and particularly from the nationwide Reappraisal of 1945-46, that no valid comparisons would be possible and consequently no trends ascertainable. Additional questions were

directed to the omission of any consideration of cutting effects on watershed conditions, to the concept of rating productivity against standards based on practical attainability rather than biological potentials.

Strong objection to the revised plan was quite limited, as evidenced by subsequent denials of access upon request by field parties for permission to survey recently cut areas. These included only six large ownerships comprising in total 1.5 million acres of commercial forest land or 0.3 percent of the national total and 2.1 percent of the total number of large ownerships.

The Forest Service has never modified its original views that the condition of recently cut lands is an important factor affecting the future supply of domestic timber and that study of such conditions is essential to any comprehensive appraisal of the forest situation. However, the original proposals of the Forest Service for conducting such a study had been considerably modified, and beneficially so, by the lengthy review and developmental period preceding release of the final plan. In considering the comments received subsequently and described briefly above, the Forest Service felt that a reasonable balance had been reached in meeting constructive suggestions and that further review would be beyond the point of diminishing returns. It also felt that the concepts and procedures developed were reasonable and represented a step forward in dealing with the subject of cutover lands which will continue to be of recurring concern.

CONCEPTS

Four major elements present in varying degree on all cutover areas were chosen as the basis for classification of productivity on recently cut lands. These four elements were those judged to exercise the greatest combined influence on current and prospective growth of timber in both quantity and quality. They are (a) existing stocking, (b) prospective stocking, (c) species composition and (d) effect of felling age or premature cutting.

Numerical standards were developed for each element based upon available technical forestry information, but tempered by judgements as to practical attainability under current operating conditions and status of knowledge. Thus, the standards do not represent biological potentials nor were they based upon consideration of the growth needed to satisfy prospective requirements for timber products. This concept of practical attainability is highly important to interpretation of results. Adaptability to the widely varying nature of our forests was provided by developing separate standards for the important sites or localities within each forest type of every region.

In application of standards, field measurements of each element taken on a recently cutover area were calculated as a percentage or proportion of the appropriate standard. Such percentages were called factors or ratings. A method of calculation was adopted which integrated these factors into a single productivity index. The possible range of such indexes was 0 to 100.

The standards together with instructions for calculating factors and productivity indexes and for field procedures were incorporated in manuals of criteria for each region. These are summarized separately as Section E of Chapter IX, Appendices, and entitled Criteria for Rating Productivity of Recently Cutover Lands. Each field examiner was provided with a copy of the appropriate regional manual and trained in its use.

Because of limited facilities, the intensity of survey coverage was aimed at reliable statistics for each region only, but provision was made for adequate statewide data where local interest supplemented regional sampling to the extent necessary. The method of choosing ownerships for examination varied with size class. Sampling methods were used for the extremely large number of small private ownerships. For private ownerships of medium size, sampling was used in States where this size class was numerous but the recent cutovers of all were examined in States with few such ownerships. With a single exception, the recent cutovers of all large private ownerships were examined in each State. Generally, this type of full coverage was also used for public lands. The public lands and large private ownerships were examined separately by working circles or blocks.

No area was examined which had been cutover prior to January 1, 1947. On an individual ownership the most recent cutting made between that date and the time of examination was chosen for field measurement. This procedure was followed for the cutover portions of each forest type on the ownership. Thus a factor or rating for each element and a combined productivity index was calculated for the cutover portion of each forest type on every ownership examined. On many ownerships this procedure resulted in two or more indexes for each depending upon the number of types with recent cutting. In addition to this productivity data field examiners also recorded for every ownership examined the area of each forest type in which recent cutting had occurred, the total commercial forest area and other related information required by the plans.

Occasionally no recent cutting had taken place on an entire ownership or on one or more forest types of an ownership. These areas were considered as non-operating. On each ownership with recent cutting only the total area of forest types in which cutting had occurred was classified as the operating area of the ownerships. About 48 percent of all commercial forest land was classified as operating area.

Compilation of results was begun by dividing the entire range of productivity indexes into 3 broad classes as follows:

Productivity index range	Equivalent productivity class
0 - 39	Low
40 - 69	Medium
70 - 100	High

The next step was to tabulate operating areas by productivity classes in accordance with the indexes previously calculated from field measurement. Finally, the total operating area in each productivity class was converted to a percentage of all operating area. Thus, final expressions of results were proportions of all operating area in each of the three productivity classes. Such tabulations were prepared by ownership type and size class, region, section and forest type group. Additional similar tabulations were prepared to show the relative effects of each element on the proportion of area in the various productivity classes.

Earlier discussion of concepts pointed out that standards for each element were based upon current practical attainability. A productivity index of 100 means that such standards were fully met for all four elements. Any result showing that 50 percent of the recently cut lands in a given region were found to be in the high productivity class means that 50 percent of such lands met 70 to 100 percent of the standards practically attainable.

The preceding summary of concepts and procedures is amplified on the pages immediately following. Much of this amplification is necessarily technical and quite detailed. If the reader does not wish to go into further detail as to concepts and procedures, he should pass over this portion of the report and turn to the discussion, "How High Are the Standards," or to the results. However the fuller explanation will contribute significantly to better understanding of the results and is recommended.

Basic Premises

The following enumerated items summarize the guide lines or framework for the procedures used in rating the productivity of recently cutover lands.

The Elements Adopted

The major elements considered most directly related to current and prospective growth on cutover areas and which could be measured on the ground were chosen for study. The elements chosen were (a) existing stocking, (b) total stocking, i.e., existing plus prospective stocking, (c) species composition, and (d) effect of felling age with relation to maturity. Concentration on these four elements left out of consideration other elements of forest management such as adherence to sustained yield policies, existence of written forest management plans, and any silvicultural systems or methods found in effect. Thus the study does not appraise the status of management.

Adoption of these elements also omits any direct measure or recognition of the intent to practice forestry on any ownership or the degree of effort expended to create a given set of conditions on a cutover area. On the basis of the four elements, the end result of the cutting is subjected to measurement and appraisal whether it be accomplished by accident or by carefully designed effort. This differs basically from the Reappraisal concept which rated forest practices

on a combination of standards for cutover areas and degree of forestry effort expended on the entire ownership.

Standards Expressed Statistically

The standards for each element chosen as a basis for rating individual cutover areas were expressed in specific numerical terms, insofar as possible, and in definitive specifications where not. Drawing up of standards was based upon summarization of many years of research and experience where such information was available and experienced judgement was not.

Basic Level of Standards

The standards of measurement chosen for each of the four elements represent what was judged to be the most productive condition currently attainable under prevailing operating conditions, and the status of knowledge available for each forest type and region or subregion. Thus the standards represent conditions practically attainable. They are not related to any specified portion of the biological potential for growth. Neither are the standards aimed at capturing the growth needed to meet future wood requirements. Standards developed on the basis adopted are likely to be high in comparison to those practical of attainment a decade or more ago. They will likely prove to be low in the future as economic situations and technological advances favor the development of forestry. Considerable emphasis in developing standards therefore was placed on the exercise of judgement as to the desirable condition of cutover areas that was currently practical of attainment. The ways in which judgement was applied in arriving at standards under this concept is previously described under the subtitle, "How Concepts Were Developed."

Standards finally adopted are summarized for each forest type and locality in the separate document, "Criteria for Rating Productivity of Recently Cutover Lands," Section E of Chapter IX, Appendices.

The Productivity Index and Class

The four elements used in appraising the productivity of recently cut lands were integrated into a single productivity index. The entire possible range of indexes, 0 - 100, were subdivided into three broad productivity classes, high, medium, and low, in accordance with the following classification:

Productivity index range	Equivalent productivity class
0 - 39	Low
40 - 69	Medium
70 - 100	High

The index calculated for each area examined was assigned to the appropriate productivity class.

This concept of classification differs from that of the Reappraisal which used five levels of forest practice to express results.

The classification presented above and the preceding concept of basic level of standards are highly important to the understanding and interpretation of findings. Results are expressed in terms of the proportions of area found to be in the high, medium, or low productivity classes. A statistic showing that 50 percent of the recently cut lands in a given region were in the high productivity class simply means that 50 percent of such lands attained 70 or more percent of the standards currently attainable under the prevailing operating conditions and status of knowledge.

Attainment of a high rating does not imply that increases are impossible over the growth associated with this rating. Such increased growth would follow advances in knowledge of timber growing and development of means for making this knowledge effective on the ground. These advances and developments would result in practical attainability of standards higher than those adopted. Occasionally ownerships were found during the survey on which cutover area conditions already exceeded the standards. Such ownerships usually were those characterized by operating conditions more favorable than average, high proportions of the better timber growing sites, or exercise of superior skill in conducting forestry programs.

Forest Types Rated Individually

Appraisal of recent cutovers was done separately for each forest type. Types vary widely in characteristics such as ability to reproduce naturally, in species composition, in inherent capacity to produce wood under a given degree of forestry effort. Types to be recognized were chosen locally but, in final summarization, all were keyed as subtypes into the major type groups recognized by the Forest Survey and used in other phases of the Timber Resource Review. A part of the final results is an expression of cutover condition by these major type groups. Thus in field examination of the ownerships chosen, a separate rating was made for the recently cutover portion of every type within each ownership. This differs basically from the Reappraisal concept which provided for assignment of each entire ownership to one of the five forest practice levels adopted by that survey.

Only Recent Cuttings Rated

Only cuttings made between January 1, 1947 and the time of examination in 1952 or 1953 were subject to examination. This choice of a specific recent period provides for a better expression of current conditions on such lands than if all cutover areas were examined without regard to the time of cutting. This is particularly important at a time when forestry appears to be advancing as rapidly as in the past decade.

Within this time period, the general rule was adopted to appraise on each ownership examined the most recent cutting made since January 1, 1947. Some modifications to this rule were adopted for specific types in a few regions.

Goals of Survey Coverage

The general framework of field coverage involved sampling surveys among the numerous small owners, either sampling or full canvass among owners of medium size depending upon their numbers in each State and full coverage of public lands and large private ownerships. Field examination on individual cutover areas consisted of specific counts or measurements on sample plots or at examination points distributed throughout each unit of cutover land examined. The intensity of sampling used on each unit was based on general guides derived from preliminary trials conducted in a variety of forest types and on cutover areas of various sizes.

Adaptability Sought

The basic method of rating and the standards or criteria were designed with a view to providing a high degree of adaptability. Annually, timber cuttings are made in literally hundreds of combinations of forest type, subtype, site and other conditions of forest stands. Resulting conditions of cutover lands likewise varies widely. The method of rating used provides a high degree of flexibility through consideration of the four different elements recognized. Further adaptability is provided in the standards for each type by recognition of different sites or of differences between localities within a broad forest type.

Method of Expressing Results

With a productivity class determined for the cutover portion of each forest type on every ownership examined, a number of alternatives are available for expressing final results. The earlier discussion of previous related appraisals has shown that volume, several measures of area and numbers of owners have all been used to weight or average the findings. Careful study was devoted to a number of alternatives. The results showed that some methods emphasize the "high" aspects, some the "low." Such extremes are inherent in these methods. The one finally adopted gives results falling between the extremes shown by others.

Briefly, the method adopted consists of the following steps:

1. Determination, for every ownership examined, of the area of each forest type in which cutting had been done since January 1, 1947. Each area was considered to be a unit of "operating area." The sum of such units for a single ownership was defined as the "operating area" of the ownership. The sum of the "operating areas" for all the ownerships in a given size class is thus the "operating area" within that ownership size class.

2. Assignment of each unit of operating area to the productivity class within which it falls for the particular tabulation desired whether it be ownership class, region, or a combination of these two.

3. Calculation of the percentage of all operating area in each productivity class.

This process can be illustrated by assuming that a forest ownership of 600 acres contained three forest types of 200 acres each with a part of each of two types cutover since January 1, 1947. Here the operating area is confined to the two types with cutting. The operating areas for the ownership is thus 400 acres. Assume further that the cutover portion of one type was found to be in the high productivity class while the cutover portion of the second type was found to be in the low productivity class. In this example, the 600-acre ownership would contribute 200 acres of operating area to the high productivity class of final tabulations and also 200 acres to the low productivity class. Note that average ratings for individual ownerships were not used. Had they been used, the entire operating area of 400 acres would probably have been assigned to the medium productivity class. Thus the final results provide an expression of the range in productivity class over the operating area. Under concepts of the Reappraisal, the entire 600 acres of the ownership would have been assigned to a single class.

Procedural Concepts

The four elements chosen to express productivity, their importance, and the general methods adopted for expressing them as standards are discussed below. The standards themselves and the working details of field examination and calculation are contained in the separate processed release, "Criteria for Rating Productivity of Recently Cutover Lands," Section E of Chapter IX, Appendices.

The most useful measure of productivity on any cutover area would be the current and future annual or periodic growth in terms of board feet and cubic feet by species or species group. Since reliable methods of determining growth directly on cutovers and on the large scale required for national surveys are not available, less direct means were used. Therefore certain specific conditions of cutover areas, directly affecting growth, were chosen as a basis for appraising productivity.

Existing Stocking

Growth of forest stands varies with stocking, hence a measure of stocking on the ground is essential to appraisal of current and future productivity. In its simplest terms, stocking is expressed in numbers of trees per acre. For purposes of this survey, existing stocking consisted of trees on the ground immediately after cutting plus those which had become established between the time of cutting and the time of examination. But not all trees on the ground are useable even if of merchantable size, because of defects. Also some are over topped by living cull trees or noncommercial species and their growth thus greatly reduced. Hence a "crop tree" concept was adopted which limited the count of existing stocking to those trees of commercial species found currently or potentially productive. The crop tree concept was applied to trees of all sizes beginning with well established seedlings.

For each forest type or subtype, and where deemed important by site or geographical area within a type, stocking standards were drawn up showing the number of crop trees per acre of each size class considered to constitute standard or 100 percent stocking. Field procedures were devised by which any count of crop trees on a recently cutover area could be translated into a percentage of the standard stocking.

In developing standards, the basic references were normal yield tables, reports of the Forest Survey, and many technical publications relating growth to stocking. These relations were modified and adjusted to provide standards judged to be attainable under prevailing operating conditions. The methods by which judgement was applied is described in a previous discussion entitled, "How Concepts Were Developed."

The existing crop trees of commercial species were also classified into "desirable" or "acceptable" groups as explained further in the discussion of composition.

Prospective Stocking

Stocking is often in a state of rapid change for several years after cutting, particularly where conditions are favorable for establishment of new trees. Since field examination was made frequently within only a year or two after cutting, a fair appraisal of stocking requires consideration of the prospects for additional new trees. Prospects for stocking depend upon a number of factors such as the seed sources left on the ground, the natural seed bed conditions, the density of inhibiting vegetation such as cull trees, noncommercial species or brush, animal populations, topographic features and others. These individual factors vary widely in importance between forest types, age classes, soil conditions, and localities. All available information regarding effects of such factors on establishment of new trees was summarized in standard tabulations and procedures for estimating the additional stocking expected from field measurement of the important factors. The inhibiting nature of some factors as well as the contributing or beneficial nature of others was recognized in these processes.

Plans for planting were also considered in situations where both existing and prospective stocking were poor. On such areas, stocking was adjusted to the level of past success in planting on the ownership if tangible evidence was available that planting would be done. The evidence required to qualify for such an adjusted rating consisted of outstanding orders, contracts, or similar commitments for planting.

Prospective stocking added to existing stocking provides a more valid estimate of the over-all stocking condition than does existing stocking alone.

Species Composition

Many forest types in the United States contain large numbers of species. In most types, the commercial species vary in ability to grow, in usefulness, and hence in value. Some are of relatively limited use. There is frequently a strong tendency, in harvesting forest products, to remove the species of greatest current value, leaving marginal species to occupy the ground in greater proportions than before cutting. Repetition of this process during several cuts on the same area results in deterioration of species composition. The degree of this change varies widely with forest types, economic situations, amount of forestry effort, and the time over which periodic cuttings have occurred.

During recent years, there has been a trend toward greater use of the less valuable species as a result of new products or uses but also in response to high prices and limited supplies of better species. But with few exceptions the species whose inherent technical properties have resulted in a preferential position for a long time are still the most useful and valuable in our economy.

Some of the marginal or less desirable commercial species grow wood as fast or even faster than some of the preferred species. However, poor quality or technical properties of the wood limit the utility of such growth. A measure of such limitations was devised by first classifying the commercial species of each forest type or subtype into the two groups, "desirable species" and "acceptable species." Noncommercial species were not included in either group nor was any direct count of their numbers made at any stage of the rating procedure. However, their influence was reflected in the count of existing crop trees since competitive effects of noncommercial trees occasionally disqualified as a crop tree an otherwise desirable one. Also the presence of noncommercial species sometimes limited the area otherwise available for prospective stocking.

In the classification of commercial species referred to above, recognition was given to many local variations and modifications. Such variations appear in the voluminous footnotes accompanying the tabulations of species in the Criteria of Chapter IX. They also have been taken into account in the general instructions appearing in sections of the Criteria dealing with species classification.

The second step in taking account of composition was establishment of a standard requirement that at least 50 percent of the stocking on a recently cutover area consist of species classified in the "desirable" category. A procedure was devised for computing a composition factor that reduced the stocking percentage if composition was found to be less than 50 percent. Stocking percentage was unchanged if the composition standard was met.

Thus, on any cutover area, if half or more of the stocking consisted of desirable species, the composition factor was 1.0. If less than half of the stocking consisted of desirable species, say 40 percent, the composition factor was computed as follows: $\frac{40}{50} = .80$. In brief, the composition on this area was 80 percent of the standard.

Literal application of this procedure might, in some cases, result in a zero composition factor. This could lead to the unrealistic implication that the growth of a forest stand consisting of "acceptable" species only would have no utility whatever. Hence, a minimum composition factor of 0.5 was adopted. No composition factor lower than this minimum limit was applied.

Effect of Felling Age or Premature Cutting

Forest stands grow in natural cycles. These cycles or natural growth trends have been defined by study of the average annual growth of many species. First it is necessary to define average or mean annual growth. The term refers to the growth calculated by dividing the volume of a stand of timber by its age in years. Usually mean annual growth is expressed in units of volume per acre at a given age. By calculating the mean annual growth in stands of a given species or forest type for a series of ages, the changes of growth with advancing age can be determined. All past investigations of this kind have shown that from the age at which volume can be measured in useable products the mean annual growth increases rapidly with age, reaches a peak and declines. This basic growth cycle is illustrated in figure 1. Using it as an example, we see that the peak of mean annual growth is reached at 125 years. If clear cut, then the yield will represent the accumulation of annual growth amounting to an average of 100 volume units per year for 125 years, the maximum attainable. But if clear cut at 75 years an average annual growth of only 80 volume units or 80 percent of maximum would be realized. Partial cuttings such as thinnings or improvement cuttings made at ages younger than those of peak annual growth tend to maintain or increase subsequent growth of the stand and add to the total volume harvested during a complete growth cycle. Such partial cuttings therefore have beneficial effects upon productivity, while clear cutting at young ages reduces it.

The general relationship shown in figure 1 has been found true for all species, but the rate at which average annual growth increases, the age at which the peak occurs, the period over which this peak is maintained and the rate of decline following the peak varies with species, growth potential of the soil, and other environmental factors. Likewise the general relation holds whether the average annual growth is measured in board feet, cubic feet, or cords. The main effect of different product measures is that peak growth is reached at younger ages when the product admits small trees. Hence the maximum growth is attained at younger ages for cordwood than for sawlogs.

Fig. 1 - Typical growth cycle of forest stands

Because of this growth cycle, clear cutting prior to the age at which peak growth is attained reduces the mean annual growth realized as well as the total yield recovered. Conversely, if clear cut after the peak the yield recovered is somewhat less, but for most species the value recovered is higher due to the greater proportion of high quality wood in older trees than in younger ones. However, the relation of age to the volume and volume growth of different quality levels or grades of wood have been insufficiently studied in the United States. Therefore specific information is unavailable for development of standards including consideration of the growth of quality wood. Use of felling age in this study is therefore limited primarily to effects upon growth in volume.

The discussion of figure 1 has shown how the clear cutting of timber at ages younger than those of peak growth reduces the yield and the growth attained. Such cutting has been termed "premature cutting." If such cutting becomes prevalent in a county, a State, or an ownership class, the average annual yields of timber harvested therefrom are materially reduced. The growth attainable by any degree of stocking and composition is likewise reduced by premature cutting.

Through use of the specific growth cycle relationships illustrated by example in figure 1 and established for many of our species, factors were derived showing the portion of attainable growth realized by clear cutting at given ages. These factors expressed as decimals of attainable growth were applied to the stocking rating as modified by composition.

In devising standards for evaluating effects of premature cutting, all available information on growth cycles was used. Fortunately some information has been accumulated for most of the major species or types. Where not available, the judgement of experienced foresters was called upon to devise standards. In a few cases, this resulted in the substitution of tree diameter for age as a standard for judging felling age effects.

Standards were set up for each species or for species groups by site or geographic area within a forest type showing the percentage of the peak growth attained at various ages. These percentages express the effects of felling age. In the example presented by figure 1, the felling age factor for a stand cut at 75 years would be .80. Thus these factors estimate the proportion of the attainable growth realized by cutting at given ages. In field application, the ages of stands clear cut were determined by annual ring counts on stumps and the appropriate felling age factor found by reference to the Criteria.

Modifications of this general concept were necessary in application and these are summarized below:

1. Felling age factors were applied only to recently cutover lands which were clear cut or to the clear cut portions of such lands. For purposes of this survey, a clear cutting was defined as one which removed 80 percent or more of the

trees which were merchantable for the products harvested and which resulted in removal of substantially all of the overstory present before cutting.

2. A number of situations were recognized where determination of felling age effects was not appropriate. These occur where stand conditions indicate that the future volume growth will be low compared to that resulting from clear cutting and starting a new stand. Examples of this are young stands badly damaged by fire or forest pests; over-mature timber beyond the age of peak growth and where growth will continue to decline; young stands where initial low stocking resulted in limby trees of such poor quality as to create doubt regarding the usefulness of any additional growth.

   There are also a few wood products based on such strict or specialized standards that volume of wood involved is a minor consideration. Examples are Christmas trees, poles, piling. Here the greatest usefulness of such trees is reached at a stage in development when they comply with product standards. Effect of felling age was not determined for the relatively limited amount of clear cutting for these products.

3. The effect of felling age was appraised for the general size class of product removed. Thus where small trees were cut for cordwood products, the effect of felling age was based upon the age of peak growth measured in terms of cords or cubic feet. Where sawlogs were removed, the effect of felling age was based upon the age when growth is at a maximum in terms of board feet. Hence the procedure included neither direct nor indirect judgement as to the desirability of either present or future requirements for different products. A free choice of products objectives was assured.

   The standard by product size classes are included in the Criteria of Chapter IX together with the local modifications provided for and examples of detailed methods and calculations for application of felling age factors in both even-aged and many aged stands.

Methods of Calculating Productivity Index

Thus far the discussion of procedural concepts has been limited to discussion of four basic elements chosen to express productivity of recently cut lands. Only brief reference has been made to the method of integrating these into a single index of productivity. The following discussion will explain the methods followed in calculating this index and the reasoning basic to the methods.

The first two elements closely related to growth, i.e., existing stocking and prospective stocking, together obviously constitute the total stocking from which the next cut of forest products will be

derived. The first step in deriving a single index of productivity was simply adding the stocking percentages for existing and prospective stocking. The result is a rating of total stocking expressed as a percentage of the stocking standard chosen to represent 100 percent stocking.

The previous discussion on species composition has shown how poor composition reduces the utility and value of the current and expected growth. A composition standard was presented. Also, for situations where field examination showed that the standard was not met, a method was presented for calculating a composition factor. This factor appraises the limitation placed upon the utility and value of the growth due to substandard composition. It is expressed as a proportion of growth attainable by a standard composition for the total stocking found. Thus the factor for standard composition is 1.0, but for substandard compositions is 0.95, 0.90, 0.85, or some other decimal not lower than 0.5. Expressed in this way, as a proportion, the mathematical relation of total stocking to composition is one of multiplication. As an example, assume a total stocking of 80 percent and a composition factor of .9. The second step in deriving a final productivity index then is the calculation 80 x .9 = 72. The result, 72, is the rating for total stocking modified by composition.

The effects of felling age or premature cutting in limiting growth on clear cut areas have also been described. The growth cycle shown in figure 1 has been used to illustrate how the effects on mean annual growth of cutting at a given age can be expressed as a proportion of the growth attainable at the age of peak growth. The relation between total stocking modified by composition and the final element of felling age is again one of multiplication. In the event that a felling age proportion or factor of .80 was found applicable to the example used in the discussion of composition, the calculation would be 72 x 0.8 = 58, the final productivity rating.

More detailed examples and sample calculations are included in the Criteria of Chapter IX. Here also will be found the variations in procedure and standards which were adopted in various sections of the country.

Procedures in Brief

Ownership Classification

All preceding related surveys have shown the importance of ownership. Hence a basic consideration prior to field examination was the classification of forest ownerships. For purposes of this survey, each ownership was classified both as to size class of commercial forest land and type of ownership. The classifications used are as follows:

Size Classification for Private Ownerships

Class 1, 50,000 acres or more, Large owners
Class 2, 5,000 - 50,000 acres, Medium owners
Class 3, under 5,000 acres, Small owners
Class 3a, 500 - 5,000 acres
Class 3b, 100 - 500 acres
Class 3c, less than 100 acres

Minimum size limits adopted for Class 3c were 3 acres in the East and 10 acres in the West.

Classification by Type of Owner, All Ownerships

Private forest lands	Public forest lands
1. Farm	1. National forest
2. Lumber manufacturer	2. Bureau of Land Management
3. Pulp manufacturer	3. Indian
4. Other wood manufacturers	4. Other Federal
5. Other private	5. State, country, municipal

Sampling Method

Recently cutover lands of the numerous small private ownerships were sampled by two methods: (a) examination of all ownerships in 2,500-acre sampling areas located within randomly chosen counties in each State of each region, (b) compilation of lists of small ownerships in each State of a region and random selection of ownerships from such lists. The first of these methods was used primarily in the East and the second in the West. Medium sized private ownerships were sampled in States with 15 or more such ownerships, but all of them were examined in States with less than 15 ownerships of this size class. All large private ownerships were examined except in Florida where their number justified sampling procedures. All Federal ownerships in a State were examined, including those of less than 5,000 acres. State, county, municipal, and other local public forests of 5,000 acres or more were also covered by complete canvass. Public ownerships, other than Federal, of less than 5,000 acres were covered by sampling either on the list or area basis previously outlined for small private ownerships.

For public ownerships organized on a working circle basis, each such working circle was viewed as a separate holding for individual examination and reporting. Where public lands were not so organized, each separate unit or block of land recognized by the responsible administrative agency was considered to be a separate recording unit and the recently cut lands in each examined and rated. This same procedure was applied to large private ownerships.

Previous mention has been made of six large ownerships comprising a total of 1.5 million acres to which access was denied for purposes of making the specific examinations of recently cut lands required by the plans. The areas of these six ownerships are included in

statistics of total commercial forest area by various size classes and types of ownership. The operating area of these ownerships and the productivity of recently cut lands on them was not ascertained and are therefore not included in any statistics of operating area or productivity.

The Survey on an Individual Ownership

The major steps in field procedure are summarized by using a hypothetical small ownership as an example. Figure 2 is a map of such an area. It is part of a sample that comprises a given percentage of the land area being sampled. The areas determined by survey of this ownership and all other sample ownerships are multiplied by a factor or "sample multiplier." This multiplier is 100 divided by the percent of total land area in the samples.

The forest land on this property consists of 120 acres. The oak-pine type covers 50 acres and no cutting has taken place in this type since January 1, 1947. The remaining 70 acres is pine type, a part of which was cut since that time.

This basic information was obtained by field examiners from a variety of sources such as an interview with the owner, county records of various agencies, interviews with neighbors, local foresters, by consulting aerial photographs. These photographs were a major source of information particularly for estimates of the area in each forest type on an ownership.

With the general location of the cutover area ascertained, the field examiner made a reconnaissance to determine roughly its area and shape and a route of travel was determined that would represent all conditions. By reference to guides in a regional field manual, the number of one-fifth acre sample plots to be measured in the East or the number of sample points from which measurements were taken in the West and the distance between plots or points appropriate for a cut-over area of the approximate size to be examined were determined. Each plot or point was then located on the ground, measurements taken, and computations completed to arrive at the percentage of existing stocking, total stocking (existing plus prospective), stocking modified by composition if required and the latter modified by effect of felling age if required. The last computation resulted in the productivity index.

Thus in the example shown by figure 2, there were six sample plots which provided six separate ratings of existing stocking. These were averaged to get a rating of existing stocking for the tract. Average ratings for each of the other three elements were derived similarly from the appropriate records for these six plots. All average ratings were recorded on a standard form for the pine type on the particular ownership together with identifying information and other observations made on the property to meet objectives of the survey. Had there also been recent cutting in the oak-pine type, a separate examination of this cutover area would also have been made. Data similar to those described for the pine type would have been recorded separately for the oak-pine type.

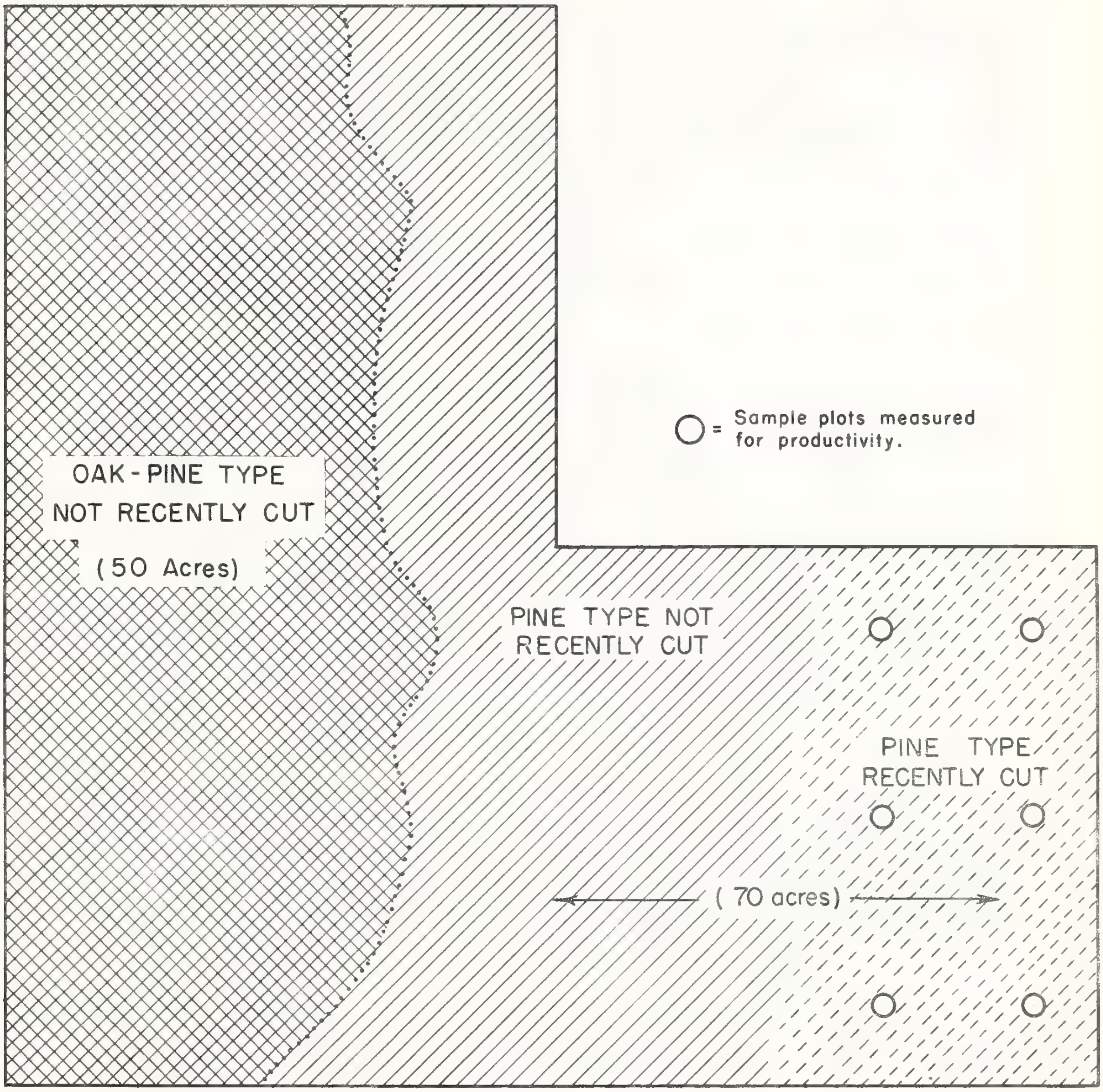

Fig. 2 - Example of small ownership containing 120 acres of commercial forest land.

Essentially the same system was used throughout the country. Methods in the East and West varied in that sample plots were used universally in the East but the sample or observation "point" was adopted for western conditions. Both the sample plot and sample point systems are described in the Criteria of Chapter IX.

How the Survey Results Were Summarized

The methods, in broad outline, of how the ratings from this example would become part of final results is of interest. Assume that the final average productivity index calculated from the six plots shown in figure 2 was 58. Reference to the classification of indexes shows that this rating would be included in the medium productivity class. Since there were 70 acres of pine type, part of which was cut, and no cutting in the oak-pine type, the operating area of this property was recorded as 70 acres and the productivity level as medium.

To follow the summarizing of this final observation, refer to table 1, page 27. This table shows that for the country as a whole 32 million acres in ownerships of 100 to 500 acres were recorded as operating. The ownership used as an example contributed to this 32 million acres. Note further from table 1 that 36 percent of the operating area in the 100-500 acre ownership class was found to be in the medium class of productivity. This percentage was derived from a tabulation of results showing that there were 11.5 million acres of operating area in the medium class. This area represented 36 percent of the 32 million acre operating area in the 100-500 acre ownership class. The example of figure 2 contributed to the total of 11.5 million acres in the medium class.

HOW HIGH ARE THE STANDARDS?

In devising standards around the basic premise that they should reflect conditions attainable under current operating conditions, judgement is necessarily used to interpret the technical forestry information at hand. The varying opinions brought out during the process of applying judgement to meet the basic premise are the source of conflicting views on standards.

Some feel that the standards are too high and therefore will emphasize pessimistic aspects. Others have expressed the opinion that standards are too low. A number of considerations could have been included in the basic premises and procedural concepts that would have led to stricter standards. The more important of these are discussed as enumerated below:

1. Standards could have been built up on the basis of trends toward more intensive forestry or of meeting future requirements. Standards developed on either of these bases would be higher than those adopted. However, it was felt that standards related only to judgements of current and reasonable attainability under average operating conditions would be of more practical value.

2. Procedures for measuring effect of felling age made no specific provision for growth of high quality sawtimber.

   For many species, the age of maximum mean annual growth in board foot volume occurs before appreciable volumes of high quality wood are produced. An additional period of years could have been added arbitrarily to felling age standards to make some allowance for quality growth. Productivity indexes thus would have been lower, particularly in the East where premature cutting is much more prevalent than in the West. However, this was not done due to lack of any specific guide lines for such arbitrary adjustment.

3. Effect of felling age was judged on basis of size class of product cut. On the grounds of a greater relative national need for large size than small size products, effect of felling age could have been appraised against the ages at which growth of sawtimber reach a maximum. This too would have resulted in lower indexes, again primarily in the East. However, because both large and small products are needed in U. S. economy, and because no basis existed for allocating proportions of small vs. large products objectives to a specific area of land, final decision was to appraise effect of felling age on productivity for the size class of products cut.

4. The standard for composition could have been based upon a higher proportion of desirable species than the 50 percent chosen. Some reviewers recommended a standard higher than this.

5. Standards both for existing and prospective stocking were frequently exceeded on ownerships operated under effective forestry policies. Whether stocking standards are too high or too low was vigorously debated during planning stages. Because these standards were occasionally exceeded during the survey--frequently on properties under forest management--actual experience during the survey lends little support to the idea that standards are too high as an expression of the stocking reasonably attainable under current operating conditions.

6. The use of only 3 broad classes to express results of the survey tend to obscure important relations between productivity of recently cutover lands and such important factors as size class and type of ownership, geographic location, forest type group and others. The use of a greater number of classes would have provided the basis for more precise and informative comparisons.

The tables and charts which provide background for the discussion and analysis of results in the following pages are summaries of more detailed statistics found in Chapter IX, Appendices, Summary of Basic Statistics. Of these statistics, tables 22 and 23 on forest ownership and tables 70-74 on productivity of recently cut lands are the major references. These basic tables were developed in considerable detail so that others might derive summaries of particular interest to them. In some tables the detail exceeds that contemplated by the sampling standards so that sampling errors are high. Readers consulting the Appendix tables or making separate summaries from them can determine the statistical reliability of estimates by application of procedures outlined in Chapter IX, Appendices, Section D, Sampling Standards.

Public and Private Lands Compared

Nationally, 56 percent of the recently cutover lands in private ownerships were found to have reached the standards attainable under current operating conditions; that is, a little more than half of such lands were found to qualify for the high productivity class. In contrast, 80 percent of the recently cutover lands in public ownership were found to be in the high productivity class (table 1).

The importance of this contrast is apparent from the proportion of total commercial forest area in each of these two ownership categories. Table 1 shows that 358 million acres or 73 percent of all commercial forest land is privately owned. The remaining 27 percent is in various types of Federal, State, and local public ownership.

Any increases in the national level of growth needed to meet the wood requirements of our growing population and expanding economy must come, for the most part, from the large area of private lands. The condition of recent cutovers on such lands falls considerably short of meeting standards attainable under current operating conditions. Because of this and the large area involved, the possibilities of raising the national growth level are much greater on private than on public lands.

Small Private Holdings a Major Problem

Productivity of recent cutovers on private lands is directly related to the size class of ownership--the smaller the ownership, the lower the proportion of recently cut land in the high productivity class. On ownerships of 100 acres or less, which include one-third of all private commercial forest land in the Nation, only 38 percent of recently cut lands fell in the high productivity class. All small ownerships combined (less than 5,000 acres) comprise 74 percent of all private forest land and over half of all private and public combined. In this group, only 40 percent of recently cut lands qualify for the high productivity class (fig. 3).

The situation is much more favorable on the larger private ownerships. For those of the medium size class (5,000-50,000 acres), 64 percent of the recently cut lands qualified in the high productivity class. For

Table 1.--Productivity of recently cutover forest land[1/] by size class and type of ownerships, 1953 (United States and Coastal Alaska)

PRIVATE HOLDINGS BY SIZE CLASS

Size class[2/] and type of ownership	Commercial forest area		Proportion of operating area by productivity class		
	Total	Operating[3/]	High	Medium	Low
	Million acres	Million acres	Percent	Percent	Percent
3 - 100 acres	121	24	38	37	25
100 - 500	98	32	40	36	24
500 - 5,000	46	18	44	35	21
5,000 - 50,000	35	23	64	26	10
50,000 and larger	58	42	78	18	4
Total or average	358	139	56	29	15

HOLDINGS BY TYPE OF OWNERSHIP

Private:					
Farm	165	53	41	37	22
Lumber manufacturing	35	24	73	21	6
Pulp manufacturing	23	17	84	15	1
Other wood manufacturing	4	3	73	23	4
Other private	131	42	52	28	20
Total or average	358	139	56	29	15
Public:					
National Forest	85	66	81	16	3
Bureau of Land Mgt.	6	5	80	15	5
Indian	7	5	74	25	1
Other Federal	5	2	80	16	4
State	19	13	77	18	5
County and local	8	5	77	23	(4/)
Total or average	130	96	80	17	3
Total, all ownerships	488	235	65	24	11

1/ During period January 1, 1947 to date of examination in 1953 or 1954.
2/ Based on the total commercial forest area in the ownership.
3/ The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Excludes operating area on some large private ownerships on which access was denied.
4/ Less than 0.5 percent.

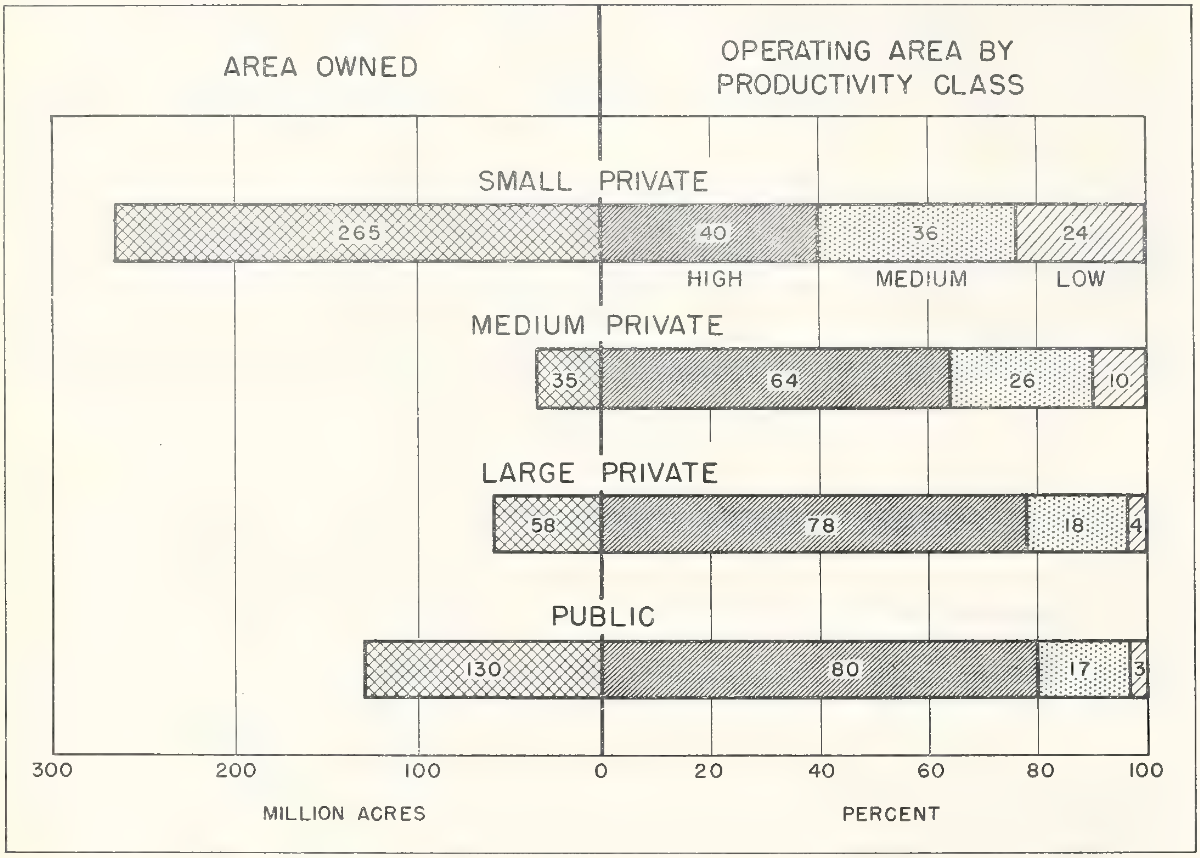

Fig. 3 - Commercial forest area and productivity of recently cutover lands, by ownership class, United States and Coastal Alaska, 1953.

large ownerships (50,000 acres and larger), 78 percent of recently cut lands were found to be in this upper productivity class. The ownerships of medium and large size together contain 93 million acres or 26 percent of the private forest land and 19 percent of all commercial forest area.

Thus, small private ownerships comprise three-fourths of all private land and the productivity of recent cutovers on this large area was found to be much lower than that of the larger ownerships. This is the major reason why productivity of recent cutovers is lower for all private land than for public ownership.

Public and Wood-Manufacturing Industry Lands Rank Highest

Results of the survey showed that type of ownership is also very important. Lands owned by pulp-manufacturing industries have the greatest proportion--84 percent--of recently cut lands in the high productivity class, followed closely by national forests, other Federal, other public, lumber industry, and other wood-using industry, with the latter two showing almost identical situations (table 1 and fig. 4). Although substantial improvement can still be made, these types of ownership--public and wood-using industries--form a group where condition of cutovers is more favorable for current and future growth than is the case for other types of ownership. While there are variations within the group, the differences are not large and they all appear to be at about the same general level of productivity.

The combined ownership of the wood-using industries amounts to slightly under 13 percent of all commercial forest land, and the public lands comprise somewhat less than 26 percent. Together these types of ownership, which are characterized by high proportions of recently cutover lands in the upper productivity class, make up only 39 percent of all commercial forest land.

In contrast to the wood-manufacturing industry and public forest lands, only 41 percent of the recently cut lands on farm ownerships was found to be in the high productivity class. On "other" private lands, the comparable figure is 52 percent.

In both of these classes of ownership, the primary interest of land ownership is generally something other than production of forest products. Farm owners, of course, are usually most concerned with production of other farm crops, with timber as a secondary interest at best. "Other" private ownerships represent a wide variety of interests. Although some land is held primarily for timber values, generally the interest in forest products is secondary to mineral, power, recreation, wildlife, or other values. Included in the other private lands are both individual and corporate holdings, but mostly they are small ownerships as shown in table 2.

Thirty-four percent of all commercial forest land is on farms, and another 27 percent is on other private lands. This makes a total of 61 percent of all commercial forest land controlled by these two types of ownership, with less than half of recent cutovers in the upper productivity class. This situation presents a serious threat to the

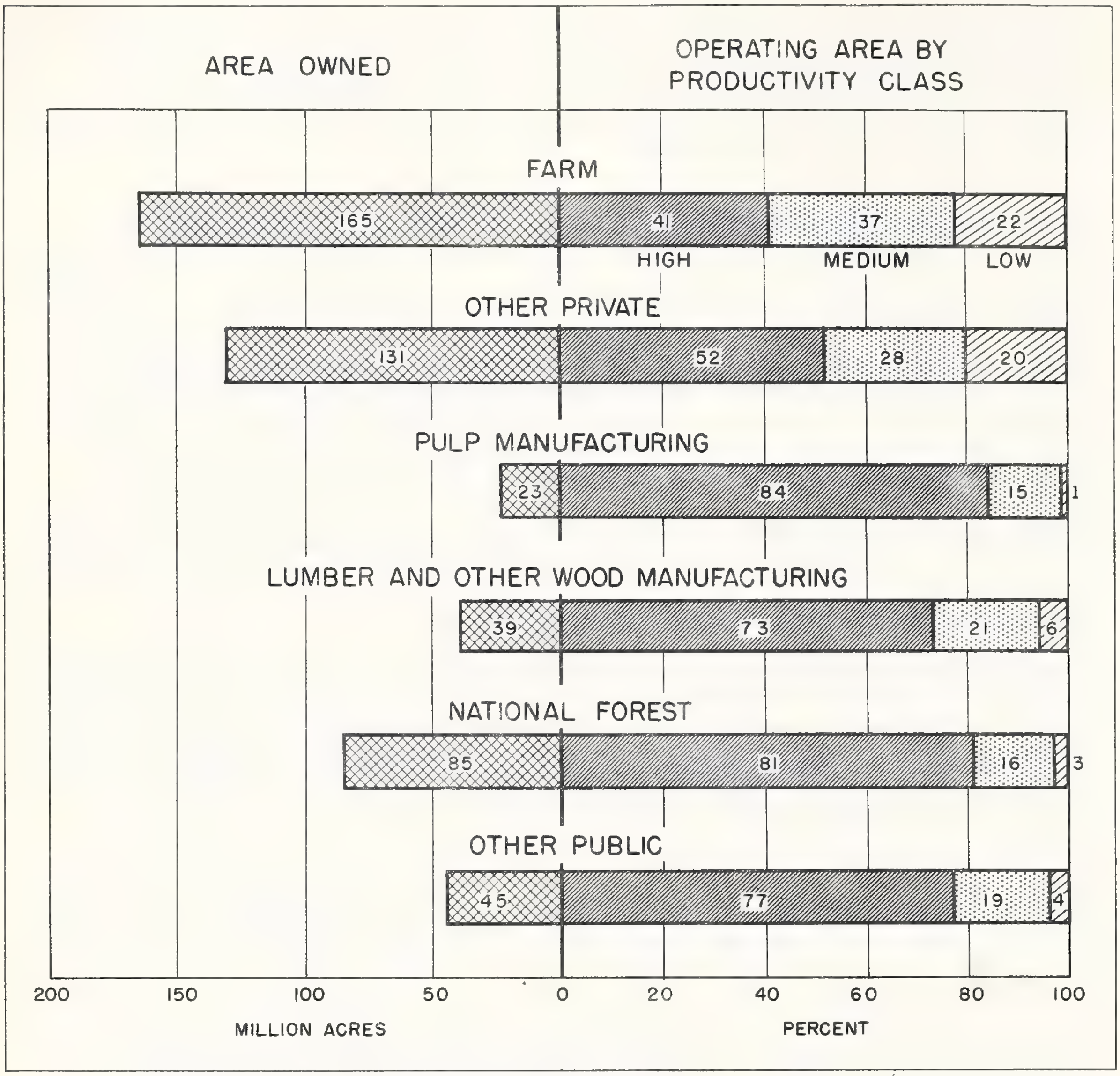

Fig. 4 - Commercial forest area and productivity of recently cutover lands, by type of owner, United States and Coastal Alaska, 1953.

Table 2.--Productivity of recently cutover private lands[1/] by type of owner and size class, 1953 (Continental United States)

Type of owner and size class[2/]	Commercial forest area		Proportion of operating area by productivity class		
	Total	Operating[3/]	High	Medium	Low
	Million acres	Million acres	Percent	Percent	Percent
Farm:					
Small	160	51	40	38	22
Medium and large	5	2	59	27	14
Lumber manufacturing:					
Small	5	3	48	35	17
Medium	11	8	74	20	6
Large	19	13	78	19	3
Pulp manufacturing:					
Small and medium	1	1	74	17	9
Large	22	16	84	15	1
Other wood manufacturing:					
Small and medium	3	2	72	25	3
Large	1	1	74	18	8
Other private:					
Small	99	21	41	31	28
Medium	16	10	56	31	13
Large	16	11	69	21	10
Total or Average	358	139	56	29	15

[1/] During period January 1, 1947 to date of examination in 1953 or 1954.

[2/] Size class based on the total commercial forest area in the ownership. Small, 3-5000 acres in the East, 10-5000 acres in the West. Medium, 5000-50,000 acres. Large, 50,000 acres or larger. Excludes 19,000 acres of private forest land in Coastal Alaska.

[3/] The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some recent cutting was done. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Excludes operating area on some large private ownerships to which access was denied.

Nation's capacity to meet future timber needs. It explains in part why farm timber lands with 34 percent of all commercial forest area contain only 15 percent of the sawtimber (see Chapter II, Domestic Supply of Forest Land and Timber).

In table 3 is shown the proportion of operating area in each type of ownership and its distribution by productivity class. Eleven percent of recent cutovers fall in the low class, and most of this--9 percent--occurs on farm and "other" private lands. Conversely, of the 65 percent rating high, only 18 percent (a little over one-fourth of the total) is on farm and other private lands.

Poorest Condition for Small Holdings Consistent for All Types of Private Ownership

The pulp-manufacturing industry is the only type of private forest land ownership characterized almost entirely by large holdings. Over half of the lumber-industry holdings are also large, but substantial portions are in the medium and small size classes. Other types of private ownership are primarily in the small size class (table 2).

Within each type of private ownership, the small size class (less than 5,000 acres) is characterized by the lowest proportions of recently cut lands in the high productivity class. Thus the proportion of small holdings has a strong influence on the condition of cutovers in each type of ownership. The influence of the high proportion of small holdings is particularly apparent in table 2 for the farm and "other" private ownership classes.

Motives for Forest Land Ownership Not Determined

This survey did not inquire into motives for forest land ownership, the degree of forestry knowledge available, nor the many other factors that may have influenced the treatment of the forest lands examined. It was limited strictly to an appraisal of the conditions that exist on recently cutover areas.

In the case of public forest lands, the responsibility placed on the agencies for their management as forest properties is probably the basic reason for the favorable growth conditions on most recently cut areas. The direct dependence of wood-manufacturing industries upon timber for raw material is reflected in the increasing adoption of policies and practices designed to keep these lands productive. The growing practice of employing professional foresters and placing on them the responsibility for forest management is commencing to show results on the land.

The contrasting poorer condition on farm and other private forest lands may be due to the competition of other activities, which subordinates interest in forest production. Lack of forestry knowledge and information on how to obtain it may also contribute to this condition. But the situations and factors responsible for the generally lower level of productivity on these types of ownership, as well as the small ownerships of all types, are not fully known.

Table 3.--Distribution of all operating area, by type of ownership and productivity class, 1953 (United States and Coastal Alaska)

Ownership class	Proportion of operating area by productivity class			
	Total	High	Medium	Low
	Percent	Percent	Percent	Percent
Private:				
Farm	22	9	8	5
Wood manufacturing	20	15	4	1
Other private	18	9	5	4
Total	60	33	17	10
Public:				
National forest	27	22	4	1
Other Federal	5	4	1	(1/)
State and local	8	6	2	(1/)
Total	40	32	7	1
Total, all ownerships	100	65	24	11

1/ Less than 0.5 percent.

CONDITION OF CUTOVER LANDS VARIES BY SECTION, REGION, OWNERSHIP CLASS, AND OTHER FACTORS

Productivity of recently cut lands was found to differ widely, from one part of the country to another (fig. 5). Examination of these differences helps to identify the relative contribution to the national level of growth made by various combinations of ownership and geographic location. This will be done by major sections--North, South, and West. Within each section there are notable exceptions to the general average and these exceptions will be pointed out in later discussion of differences by both region and type of ownership.

Condition of Cutover Land Best in the West

Generally the condition of recently cutover lands is best in the West where 74 percent of them were found to be in the high productivity class (table 4). This is primarily a reflection of the ownership pattern. In the West, 52 percent of all commercial forest land is in national forest ownership, 12 percent is in large private holdings, and 9 percent consists of other Federal lands. Thus, about three-fourths of all commercial forest land is controlled by three classes of ownership on which substantial portions of recently cut lands attain high productivity ratings. The result is an over-all situation more favorable than in either the North or the South where small private ownership predominates. Moreover, the proportion of recently cut lands in the high productivity class on small private ownerships of the West is greater than in the South and about equal to that of the North.

Notable exceptions to the generally better situation in the West are the State and local public ownerships. Only 58 percent of recently cut lands in these ownerships was found to be in the high productivity class, as compared to 83 percent in the North and 70 percent in the South.

South Has Poorest Cutover Conditions

Productive condition of recently cutover land is poorer in the South than in the other sections. The range in productivity by ownership class is greater here than elsewhere, and while the highest ratings occur in the South, so also do the lowest, and the latter involves by far the greater acreage.

Cutovers on public and on large private ownerships compare very favorably with these holdings in other sections, but the forest area in these ownerships is proportionately smaller in the South. The small private ownerships (less than 5,000 acres) are primarily responsible for the poor average condition of recently cut lands in this section. Only 34 percent of such lands on small holdings were found to be in the high productivity class, a much lower proportion than in the North and West. The significance of this situation in southern forest economy becomes apparent from the information in table 4 regarding ownership of commercial forest land. This shows that two-thirds of all the South's commercial forest land is in small holdings, and a total of nearly 1.8 million small owners are involved. Almost 80 percent of the land in

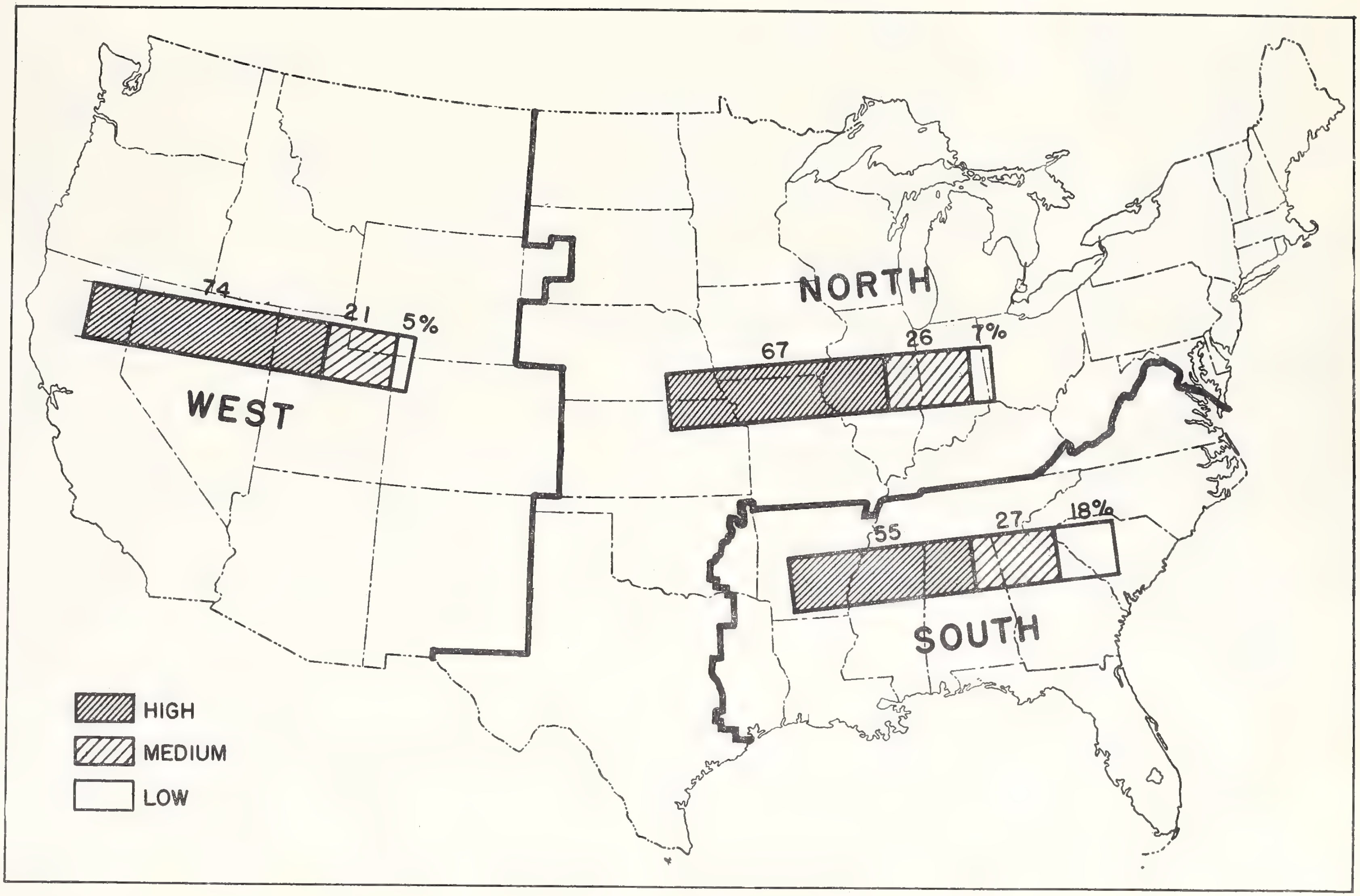

Fig. 5 - Productivity of recently cutover lands by section, 1953

Table 4.--Productivity of recently cutover lands[1/] by section and ownership class, 1953 (United States and Coastal Alaska)

Section and ownership class[2/]	Commercial forest area		Proportion of operating area by productivity class		
	Total	Operating[3/]	High	Medium	Low
	Million acres	Million acres	Percent	Percent	Percent
North:					
Small private	117	23	50	33	17
Medium private	9	5	61	30	9
Large private	16	13	71	27	2
National forest	10	9	84	16	(4/)
Other Federal	3	1	80	15	5
State and local	19	13	83	16	1
Total or average	174	64	67	26	7
South:					
Small private	128	44	34	37	29
Medium private	20	13	63	26	11
Large private	28	19	81	13	6
National forest	10	9	89	10	1
Other Federal	4	2	83	14	3
State and local	3	1	70	23	7
Total or average	193	88	55	27	18
West:					
Small private	20	7	48	39	13
Medium private	6	4	73	19	8
Large private	14	11	80	17	3
National forest	61	45	79	17	4
Other Federal	11	8	73	23	4
State and local	5	4	58	28	14
Total or average	117	79	74	21	5
Coastal Alaska:					
National forest	3	3	87	13	..
Other Federal	1	1	100	..	..
Total or average	4	4	89	11	..
Total or average, all sections	488	235	65	24	11

1/ During period January 1, 1947 to date of examination in 1953 or 1954.
2/ Size class based on total commercial forest area in the ownership. Small, 3-5,000 acres in the East, 10-5,000 acres in the West. Medium, 5,000-50,000 acres. Large, 50,000 acres and larger.
3/ Operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some recent cutting was done. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. The figures exclude operating area on some large private ownerships to which access was denied.
4/ Less than 0.5 percent.

these small ownerships is in tracts of 500 acres or less (Ownership of Forest Land and Timber, Section D, Chapter IV).

These small ownerships in the South are also of outstanding national significance. They include a total commercial forest area of 128 million acres. This is 36 percent of all private commercial forest land in the United States, and over one-fourth of all commercial forest, both public and private. The total area in these small ownerships exceeds by 11 million acres the entire commercial forest area of the West, and by 66 million acres the commercial forest owned by all the wood-manufacturing industries in the United States. Because of the situation just described, the high potential growth rate, and the greater need for softwood supplies than hardwoods, the top national problem concerned with improving growth by cutting exists on these small ownerships of the South.

Previous evidence (table 1 and fig. 4) has emphasized the significant relation between type of owner and condition of recently cut lands. The generally less favorable conditions found on farm and "other" private lands appear in exaggerated form in the South. Here both these types of ownership have much lower proportions of recently cut lands in the upper productivity class than they do in other sections (table 70, Summary of Basic Statistics, Appendices).

<u>The North Shares in Major Problem</u>

Condition of recently cut lands in the North, on the average, falls between the West and the South, but by ownership class this is true only on national forests and other Federal lands. The other classes deviate from this pattern (table 4).

Both the medium and the large private holdings show a lower proportion of recently cut lands in the high productivity class than was found for these ownerships in the South and West. This is especially marked in the large ownerships, and, as will be shown later, is due primarily to the relatively low proportion of recently cut area in the high productivity class on large private properties in New England and the Central States. State and local public ownerships rate substantially higher in the North than in either the South or West.

The small private holdings also rate higher in the North, but they are still much below the national average and constitute a problem here as elsewhere. Although less intensified, the situation is similar to that of small owners in the South. Small owners control one-third of all private commercial forest land in all regions, and the individual ownerships average smaller than in other sections so there are proportionately more owners involved.

<u>Strong and Weak Spots Identified</u>

Regional differences help to identify important exceptions to the general condition which are glossed over in broad sectional averages. Also comparisons will be made between the proportion of recently cut lands meeting the standards of high productivity for the Nation as a whole and

this proportion for ownership classes, geographical locations, or combination of these two. Such comparisons help to show the relative contribution to the national growth level of each segment of forest area, such as an ownership class, locality, or combination thereof.

Segments with proportions of recently cutover lands in the high class lower than the national average tend to hold down the national level of growth. The latter have been termed "weak spots" for purposes of discussion. Conversely, segments with proportions higher than the national average tend to raise the national growth level. These are the strong spots. First, the differences between the proportion of recently cut lands in the high productivity class for each region will be compared with the national average. Second, similar comparisons will be made by types of ownership within each region.

As has been previously pointed out, recently cutover lands of the West are in better over-all condition than those of the North or South. Most regions of the West exceed the national average (table 5). A notable exception is the Northern Rocky Mountain Region where the proportion of recently cut lands in the high productivity class falls slightly below the national average. Recently cut lands in the Pacific Northwest appear to be in somewhat better condition than those of the other western regions, but differences are small.

The fact that cutovers in the South are in poorer condition than those of North or West is traceable to both the Southeastern and West Gulf Regions. The West Gulf is especially low with only 46 percent of recently cut lands in the high productivity class. In the South Atlantic Region, condition of cutovers approximates the national average.

In the North, the Lake States Region shows cutover conditions considerably better than those of any other region. Poorest conditions are in the Central and Plains Regions, although the latter is of minor significance in the broad forestry picture.

The following tabulation summarized from table 5 shows for each region how the proportion of recently cut lands in the upper productivity class compares with the national average:

Proportion of recently cut lands in upper productivity class is:		
Over 70 percent (exceeds national average)	60 to 70 percent (approximates national average)	Less than 60 percent (below national average)
Lake States	New England	Central
Pacific Northwest	Middle Atlantic	Plains
California	South Atlantic	Southeast
Southern Rocky Mtn.	Northern Rocky Mtn.	West Gulf
Coastal Alaska		

Table 6 expands the comparison made above to include consideration of type of ownership. Those ownership classes by region which fall below the national average comprise the weak spots where the condition of recently cutover lands is limiting growth most seriously. Conversely,

Table 5.--Productivity of recently cutover lands,[1] by section and region, 1953 (United States and Coastal Alaska)

Section and region	Commercial forest area		Proportion of operating area by productivity class		
	Total	Operating[2]	High	Medium	Low
	Million acres	Million acres	Percent	Percent	Percent
North:					
New England	31	15	63	29	8
Middle Atlantic	42	14	66	23	11
Lake States	53	24	77	20	3
Central	42	11	54	35	11
Plains	6	(3/)	13	36	51
Total or average	174	64	67	26	7
South:					
South Atlantic	46	18	64	26	10
Southeast	95	47	57	23	20
West Gulf	52	23	46	34	20
Total or average	193	88	55	27	18
West:					
Pacific Northwest:					
Douglas-fir subregion	25	18	83	13	4
Pine subregion	20	13	79	18	3
Total or average	45	31	81	15	4
California	17	9	77	22	1
Northern Rocky Mtn.	34	25	62	27	11
Southern Rocky Mtn.	21	14	78	19	3
Total or average	117	79	74	21	5
Continental United States	484	231	65	24	11
Coastal Alaska	4	4	89	11	..
Total, all regions	488	235	65	24	11

1/ During period January 1, 1947 to date of examination in 1953 or 1954.

2/ Operating area of an individual ownership is the combined area of the forest types, in the ownership, in which some recent cutting was done. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. The figures exclude operating area on some large private ownerships to which access was denied.

3/ Less than 1/2 million.

Table 6.--Type of ownership by proportion of operating area in the high productivity class and by region, United States and Coastal Alaska, 1953[1]

Proportion of operating area rating high	National Forest	Bureau of Land Management	Indian	Other Federal	State and local	Farm	Pulp manufacturing[2]	All wood using industry[2]	Other private
Above national average (over 70%)	New England Middle Atlantic Lake States Central Plains South Atlantic Southeast West Gulf Pacific Northwest California Southern Rocky Mtn. Coastal Alaska	West Gulf Pacific Northwest Coastal Alaska	Lake States South Atlantic Pacific Northwest California	South Atlantic Southeast Douglas-fir sub-region, P.N.W. Southern Rocky Mtn.	New England Middle Atlantic Lake States Central South Atlantic Douglas-fir sub-region, P.N.W. California		Middle Atlantic Lake States South Atlantic Southeast West Gulf Pacific Northwest California	Middle Atlantic Lake States South Atlantic Southeast Pacific Northwest California Southern Rocky Mtn.	New England California
Approximating the national average (60-70 percent)	Northern Rocky Mtn.	Northern Rocky Mtn. Southern Rocky Mtn.		Central	Southeast	Middle Atlantic California		West Gulf	Lake States Douglas-fir sub-region, P.N.W. Southern Rocky Mtn. South Atlantic
Below national average (below 60 percent)		Lake States California	Plains Northern Rocky Mtn. Southern Rocky Mtn.	New England Middle Atlantic Lake States West Gulf Pine subregion P.N.W.	Plains West Gulf Pine subregion P.N.W. Northern Rocky Mtn. Southern Rocky Mtn.	New England Lake States Central Plains South Atlantic Southeast West Gulf Northern Rocky Mtn. Southern Rocky Mtn. Pacific Northwest	New England	New England Central Northern Rocky Mtn.	Middle Atlantic Central Southeast West Gulf Pine subregion P.N.W. Northern Rocky Mtn.

1/ Based on table 70, Summary of Basic Statistics, Appendix.

2/ Lumber and other wood manufacturing industries not shown separately because sampling was inadequate for valid comparisons by regions for these industries which have substantial proportions of total ownership in small and medium size classes.

the ownership types by regions with recent cutovers which rate above the national average are those which tend to increase the national growth level. The relative national importance of weak and strong spots can best be judged by the acreage of each in relation to the total area of commercial forest land in the country. Table 7 summarizes such relations.

Ownerships comprising about 31 percent of all commercial forest lands have recent cutovers which exceed the national average in productivity. About 53 percent of all commercial forest land consists of ownerships with recent cutovers rating below this average. The remaining 16 percent is in ownerships with recent cutovers that approximate the national average.

About 20 percent of all commercial forest land with recent cutovers rating above the national average consists of public lands and 11 percent of private ownerships. National forests comprise the largest single ownership with 13 percent, followed by lands of the wood-manufacturing industries (7.9 percent), State and local public lands (4.6 percent), other private (3.6 percent), and all other Federal lands (2.1 percent).

Most (51 percent) of the commercial forest land making up the weak spots is on private ownerships. About 2 percent was found to be on public lands. Farm ownerships contain the largest proportion (31 percent) of all commercial forest area with recent cutovers rating below the national average. Other private lands comprise nearly 18 percent, and the ownerships of wood-manufacturing industries only 2 percent.

If growth is to be increased, an important first step is further analysis of the weak spots to learn more about them. Part of the data of table 7 are expanded in table 8 to include regional consideration and more details on ownership. It is also important to determine the proportion of each type of ownership which falls below the national average of productivity and where such areas are located. This information is found in table 9.

Problems Most Widespread on Farms

Productivity of recent cutovers on farms fell below the national average in all regions but two (table 6). In no region did the productivity of recently cut lands on farms exceed the national average. Table 8 shows that farm ownership in these below-average regions contains 31 percent of all commercial forest land in the United States and Coastal Alaska, and from table 9 it is apparent that this area represents 92 percent of all forest land on farms. Because of the large acreage involved, farm forest lands of the South are the most serious weakness, with those of the North next (table 8). Regionally, the farm ownerships of the Southeast, South Atlantic, and Central States show the greatest weaknesses.

While not so widespread as farm forest lands, other private lands in the below-average category contain 18 percent of all commercial forest area (table 8). Two-thirds of all other private ownership was found to be in regions where cutover ratings on this class of land were below average (table 9). Most of the area comprising this weak spot is found in four eastern regions--Southeast, West Gulf, Middle Atlantic, and Central States. In New England and California, the recently cutover lands in other private ownership rated above the national average.

Table 7.--Proportion of all commercial forest land in public and private ownerships with recent cutovers rating above and below the national average, 1953

Ownership group	Above national average				Below national average			
	All sections	North	South	West 1/	All sections	North	South	West 1/
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Private:								
Farm	..	..	..	..	31.1	10.2	18.4	2.5
Wood-manufacturing industries	7.9	1.0	4.3	2.6	2.3	1.8	..	.5
Other private	3.6	3.0	..	.6	17.8	7.5	9.5	.8
Total	11.5	4.0	4.3	3.2	51.2	19.5	27.9	3.8
Public:								
National forest	13.0	2.1	2.2	8.7	..	..	..	..
All other Federal	2.1	.2	.6	1.3	.9	.2	.1	.6
State and local public	4.6	4.0	.1	.5	.7	(2/)	.1	.6
Total	19.7	6.3	2.9	10.5	1.6	.2	.2	1.2
All ownerships	31.2	10.3	7.2	13.7	52.8	19.7	28.1	5.0

1/ Includes Coastal Alaska.
2/ Less than 0.05 percent.

Table 8.--Proportion of all commercial forest land on which productivity of recently cut lands fell below the national average by section and region, and by type of ownership, 1953 (United States and Coastal Alaska)

Section and region	All ownerships	Public ownerships						Private ownerships			
		All public	National forest	Bureau of Land Mangt.	Indian	Other Federal	State and local	All private	Wood mfg. industries	Farm	Other private
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
North:											
New England	3.0	(1/)	..	..	..	(1/)	..	3.0	1.7	1.3	..
Middle Atlantic	4.7	(1/)	..	..	..	(1/)	..	4.7	..	..	4.7
Lake States	3.2	0.1	..	(1/)	..	0.1	..	3.1	..	3.1	..
Central	8.0	..	..	..	..	..	..	8.0	.1	5.1	2.8
Plains	.8	.1	..	..	0.1	..	(1/)	.7	..	.7	..
Total	19.7	.2	..	(1/)	.1	.1	(1/)	19.5	1.8	10.2	7.5
South:											
South Atlantic	6.1	..	..	..	..	..	..	6.1	..	6.1	..
Southeast	14.7	..	..	..	..	..	..	14.7	..	9.4	5.3
West Gulf	7.3	.2	..	..	..	.1	.1	7.1	..	2.9	4.2
Total	28.1	.2	..	..	..	.1	.1	27.9	..	18.4	9.5
West:											
Pacific Northwest:											
Douglas-fir subregion	.6	..	..	..	..	..	..	.6	..	.6	..
Pine subregion	1.1	.2	..	..	..	(1/)	.2	.9	..	.5	.4
Total	1.7	.2	..	..	..	(1/)	.2	1.5	..	1.1	.4
California	.1	.1	..	.1	..	..	..	..	..	..	..
Northern Rocky Mtn.	2.2	.5	..	..	.2	..	.3	1.7	.5	.8	.4
Southern Rocky Mtn.	1.0	.4	..	..	.3	..	.1	.6	..	.6	..
Total	5.0	1.2	..	.1	.5	(1/)	.6	3.8	.5	2.5	.8
Coastal Alaska	..	..	..	..	..	..	..	..	..	..	..
Total, all regions	52.8	1.6	..	.1	.6	.2	.7	51.2	2.3	31.1	17.8

1/ Less than 0.05 percent.

Table 9.--Proportion of commercial forest land in each ownership type on which productivity of recently cut lands fell below the national average, by section and region, 1953 (United States and Coastal Alaska)

Section and region	All owner-ships	Public ownerships: All public	National forest	Bureau of Land Mangt.	Indian	Other Federal	State and local	Private ownerships: All private	Wood mfg. industries	Farm	Other private
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
North:											
New England	3.0	0.1	..	..	..	1.6	..	4.0	13.1	3.7	..
Middle Atlantic	4.7	.2	..	..	..	4.0	..	6.4	..	..	17.5
Lake States	3.2	.4	..	1.1	..	9.0	..	4.2	..	9.2	..
Central	8.0	..	..	..	..	..	..	10.9	1.3	14.9	10.5
Plains	.8	.3	..	..	5.3	..	0.2	1.0	..	2.2	..
Total	19.7	1.0	..	1.1	5.3	14.6	.2	26.5	14.4	30.0	28.0
South:											
South Atlantic	6.1	..	..	..	..	..	..	8.4	..	18.2	..
Southeast	14.7	..	..	..	..	..	..	20.0	..	27.8	19.7
West Gulf	7.3	.8	..	..	..	12.3	1.5	9.7	..	8.6	15.8
Total	28.1	.8	..	..	..	12.3	1.5	38.1	..	54.6	35.5
West:											
Pacific Northwest:											
Douglas-fir subregion	.6	..	..	..	..	..	..	.8	..	1.8	..
Pine subregion	1.1	.6	..	..	..	1.2	2.6	1.2	..	1.4	1.5
Total	1.7	.6	..	..	..	1.2	2.6	2.0	..	3.2	1.5
California	.1	.2	..	5.1	..	..	..	..	..	..	..
Northern Rocky Mtn.	2.2	1.9	..	..	11.8	..	6.0	2.4	3.7	2.4	1.6
Southern Rocky Mtn.	1.0	1.6	..	..	23.3	..	1.6	.8	..	1.7	..
Total	5.0	4.3	..	5.1	35.1	1.2	10.2	5.2	3.7	7.3	3.1
Coastal Alaska	..	..	..	..	..	..	..	..	..	..	..
Total, all regions	52.8	6.1	..	6.2	40.4	28.1	11.9	69.8	18.1	91.9	66.6

Recently cutover lands of wood-using industries approximate or exceed the national average except in New England, the Central States, and the Northern Rocky Mountain Regions. In these three regions where ownerships of wood-using industries fall below the national average, their holdings amount to slightly more than 2 percent of all commercial forest land in the United States and 18 percent of all wood-using industry ownership.

Problem Areas Not Extensive on Public Lands

Among the various types of Federal ownership, there are relatively small areas where productivity ratings fell below the national average. National forest lands in all regions but one rated above it (table 6).

Indian lands in the below-average category comprise less than 1 percent of all commercial forest area, mainly in the West (table 8). However, they constitute 40 percent of all commercial forests on Indian lands.

Although representing only 0.2 percent of all commercial forest, 28 percent of the land in "other" Federal ownership is also characterized by productivity of recent cutovers falling below the national average. These lands include commercial forest on military reservations, game refuges, and in other types of use where production of timber is secondary to the major purposes of administration. Such lands have this characteristic in common with much of the farm and "other" private forest land.

Forest lands under administration of the Bureau of Land Management on which recent cutovers rated below the national average comprise only 0.1 percent of all commercial forest land and 6.2 percent of all land in this type of public ownership. The bulk of this area is in the California Region.

State and local public ownerships in the below-average category also comprise less than 1 percent of all commercial forest land and about 12 percent of all land in these forms of public ownership. These lands are concentrated primarily in the pine subregion of the Pacific Northwest, and the Northern Rocky Mountain, Southern Rocky Mountain, and West Gulf Regions.

Productivity of Cutovers Varies with Size Class of Residual Stand

In the determination of productivity ratings on cutover lands, a full stocking of seedlings was credited with the same productivity rating as a full stocking of pole-size trees or sawtimber trees, provided effects of composition and premature cutting were the same for all three stand-size classes. Seedlings and saplings will constitute the stocking on recently clear-cut areas, if conditions were favorable for seedling establishment and small growth received some protection during logging. Trees of pole size or sawtimber size will constitute the stocking where some form of partial cutting was practiced. Both clear cutting and partial cutting have a place in American forestry. Either method of cutting can maintain forest lands in a high state of productivity provided the method chosen is appropriate for the forest type, the

vigor and age class of timber, and other conditions prevailing on the area to be cut over. The comparative productivity of recently cut lands by stand-size class on the ground after cutting is therefore of interest.

Seedling and Sapling Stands Predominate

Forty-two percent of recently cut lands throughout the country is characterized by residual stands of seedlings and saplings (table 10). Pole stands and sawtimber stands each constitute 29 percent of recently cut lands.

Seedling and sapling stands occupy 60 percent of the recent cutovers on small ownerships of the South. Over half of the recently cut lands on all private ownerships in the West and on other public lands in the North consist of seedling and sapling stands. On these ownerships, complete or substantially complete removal of trees of pole size and sawtimber size is therefore the most common practice. In the North, seedling and sapling stands were found on 49 percent of the recent cutovers of medium and large private owners.

Fifty-five percent of recently cut lands in the West are occupied by residual sawtimber stands as compared to 15 percent and 17 percent for the North and South respectively. The western situation is due primarily to the large area of recent cutovers on public lands, particularly the national forests on which 71 percent of recent cutovers is occupied by sawtimber stands.

The presence of residual sawtimber and poletimber trees is indicative of some form of partial cutting. Adding the proportions of recent cutovers in these two stand-size classes, the totals indicate that some form of partial cutting is the most commonly followed method on national forests of all sections, on other public lands of the South and West, on medium and large private ownerships of the South, and on small private ownerships of the North. Partial cutting and clear cutting are followed in nearly the same proportions on medium and large private ownerships of the North.

Productivity Generally Highest for Residual Sawtimber

For the United States as a whole, 78 percent of the sawtimber stands left on recent cutovers were found to be in the high productivity class (table 11). This is a considerably higher proportion than was found for residual pole stands or for seedling and sapling stands. A marked exception to this national picture is found in the West where 80 percent of the seedling and sapling stands were found to be in the high productivity class, as compared to 75 percent for sawtimber stands.

Earlier evidence and discussion in this report has shown that 65 percent of all recently cut lands in the country were found to be in the high productivity class. The statistics of table 11 show that the 55 percent of seedling and sapling stands in the North were in the high productivity class. In the South, 44 percent of such stands were in the high productivity class. Thus both of these extensive areas fall below the national productivity average and tend to hold down the

Table 10.--Proportion of recently cut lands[1] by residual stand size class, section and ownership class, 1953 (Continental United States)

Section and ownership class[3]	Operating area[2]	Stand-size class: Sawtimber	Stand-size class: Poles	Stand-size class: Seedlings[4] and saplings
	Million acres	Percent	Percent	Percent
North:				
Small private	23	18	47	35
Medium and large private	18	10	41	49
National forest	9	33	37	30
Other public	14	7	37	56
Total	64	15	42	43
South:				
Small private	44	5	35	60
Medium and large private	32	25	38	37
National forest	9	39	52	9
Other public	3	29	35	36
Total	88	17	38	45
West:				
Small private	7	20	22	58
Medium and large private	15	31	11	58
National forest	45	71	5	24
Other public	12	43	9	48
Total	79	55	8	37
Continental United States	231	29	29	42

1/ During period January 1, 1947, to date of examination in 1953 or 1954.

2/ The operating area on an individual ownership is the combined area of the forest types, within the ownership, in which some recent cutting was done. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Figures exclude operating area on some large private ownerships to which access was denied.

3/ Size class of private ownership based on total commercial forest area in the ownership. Small, 3-5,000 acres in the East; 10-5,000 acres in the West. Medium, 5,000-50,000 acres. Large, 50,000 acres and larger.

4/ Includes prospective stocking.

Table 11.--Productivity of recently cutover lands[1] by section and size class of stand after cutting, 1953 (Continental United States)

Section and stand-size class	Operating[2] area	Proportion of operating area by productivity class		
		High	Medium	Low
	Million acres	Percent	Percent	Percent
North:				
Sawtimber	10	83	15	2
Poles	27	74	20	6
Seedlings and saplings[3]	27	55	35	10
South:				
Sawtimber	15	84	13	3
Poles	33	57	25	18
Seedlings and saplings[3]	40	44	29	27
West:				
Sawtimber	43	75	22	3
Poles	6	59	33	8
Seedlings and saplings[3]	30	80	13	7
Continental United States:				
Sawtimber	68	78	19	3
Poles	66	64	24	12
Seedlings and saplings[3]	97	57	26	17

1/ During period January 1, 1947, to time of examination in 1953 or 1954.

2/ The operating area on an individual ownership is the combined area of forest types, within the ownership, in which some recent cutting was done. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Figures exclude operating area on some large private ownerships to which access was denied.

3/ Seedling and sapling class includes areas of prospective stocking.

national level of growth. Evidently, clear cutting as now applied in the North and South does not create as favorable productivity levels as does application of clear cutting in the West. This does not imply that clear cutting methods in the North and South are inadvisable. Properly planned and with adequate provision for restocking, clear cutting methods are well accepted methods for maintaining high productivity in a number of northern and southern forest types. A subsequent portion of this report points out the major causes of relatively low productivity on recently clear-cut areas.

Pole stands on recently cut lands in the South and West also fall below the national average in productivity. Such stands in the South are a particularly significant weak spot because of the large area they occupy.

Class of Product Cut Related to Productivity of Cutovers

The output of pulpwood in the United States has about doubled since 1940. Yet in spite of this great increase in pulpwood use, the heaviest demand is still for the larger size products. About 70 percent of the timber being cut is in the form of sawlogs, veneer logs, piling, and other large products (Chapter III, Growth and Utilization of Domestic Timber).

During the survey, the recent cutting on each ownership examined was classified as to size of products harvested. On 65 percent of all recently cut lands, the cutting was principally for large products (table 12). On only 15 percent was the cutting primarily for small products such as pulpwood, fenceposts, and fuelwood. On the other 20 percent, cutting was for both large and small products.

The cut in the West, reflecting the general size of timber available, was almost all for large products. Here even the pulpwood comes primarily from logs of sawtimber size rather than cordwood.

In the South, where output of pulpwood is greater than any other section, cutting for small products primarily was limited to 17 percent of recently cut lands. Large products were the principal products removed on 59 percent of recently cut lands. Obviously, a large share of the pulpwood in this section comes from cutting on the other 24 percent of the operating area where both large and small products were removed.

Nearly a third of recently cut lands in the North were cut for small products primarily. Over a half of such lands in medium and large private ownerships were cut for small products. This is in sharp contrast to the South and West. A part of the reason for this contrast is the large area in the North and particularly the Lake States of species such as aspen, black spruce, and balsam, which mature at cordwood rather than sawtimber sizes. Such species are suitable primarily for pulpwood.

In both the North and South, higher proportions of recently cut lands were cut for a combination of large and small products on public lands than on other types of ownership. This is also true of national forests in the West, although the contrast is less marked here than elsewhere.

Table 12.--Proportion of recently cutover lands by size class of products harvested, section and ownership class, 1953
(United States and Coastal Alaska)

Ownership class[2]	Operating area[1]	Class of products harvested[3]		
		Large	Both large and small	Small
	Million acres	Percent	Percent	Percent
North:				
Small private	23	57	20	23
Medium and large private	18	27	19	54
National forest	9	25	71	4
Other public	14	17	60	23
Total or average	64	35	36	29
South:				
Small private	44	64	17	19
Medium and large private	32	55	25	20
National forest	9	47	51	2
Other public	3	54	39	7
Total or average	88	59	24	17
West:				
Small private	7	89	4	7
Medium and large private	15	96	3	1
National forest	45	95	5	(4/)
Other public	12	98	2	(4/)
Total or average	79	95	4	1
Coastal Alaska:				
National forest	3	100	..	..
Other public	1	100	..	..
Total or average	4	100	..	..
All sections:				
Small private	74	64	17	19
Medium and large private	65	56	18	26
National forest	66	79	20	1
Other public	30	55	33	12
Total or average	235	65	20	15

1/ The operating area on an individual ownership is the combined area of the forest types, within the ownership, in which some recent cutting was done. The operating area of any size class or type of ownership is the sum of operating areas on individual ownerships in that size class or type of ownership. Figures exclude operating area on some large ownerships to which access was denied.

2/ Size class of private ownership based on total commercial forest area in the ownership. Small, 3-5,000 acres in the East; 10-5,000 acres in the West. Medium, 5,000-50,000 acres. Large, 50,000 acres and larger.

3/ Large: Cuttings on which large products like sawlogs, veneer bolts, and stave bolts comprise 80 percent or more of the total cubic foot volume of products harvested.

Small: Cuttings on which small products such as cordwood, fuelwood, fence posts, etc. comprise 80 percent or more of the products harvested.

Both large and small: Cuttings on which both large and small products were harvested and neither made up 80 percent of the volume.

4/ Less than 0.5 percent.

Highest Ratings on Integrated Operations

In general, integrated operations utilizing both large and small products have a greater proportion of high productivity than those where only large or only small products are cut (table 13). This relationship is most pronounced in the medium and large private ownership group, and is true to a lesser degree on the "other public" lands.

On the national forests, the highest rating was on cuttings for small products, but only a limited area was cut in this manner. Most of the cutting on the national forests was for large or for both large and small products and of the two the integrated operations rated slightly higher.

Only on small private holdings did there appear to be no correlation between size of products cut and the proportion of recently cut lands in the high productivity class.

Table 13.--Productivity of recently cutover lands[1] by ownership class and size class of products harvested, 1953 (United States and Coastal Alaska)

Ownership class[2] and class of products cut	Operating[3] area	Proportion of operating area by productivity class		
		High	Medium	Low
	Million acres	Percent	Percent	Percent
Small private:				
Large products	47	39	38	23
Both large and small	13	39	35	26
Small products	14	40	26	34
Medium and large private:				
Large products	37	69	24	7
Both large and small	12	85	12	3
Small products	16	73	22	5
National forest:				
Large products	52	82	14	4
Both large and small	13	85	15	..
Small products	1	100	..	..
Other public:				
Large products	17	77	19	4
Both large and small	10	87	13	(4/)
Small products	3	86	11	3
All owners:				
Large products	153	65	24	11
Both large and small	48	73	19	8
Small products	34	61	22	17

1/ During period January 1, 1947, to date of examination 1953 or 1954.

2/ Size class of private ownership based on total commercial forest land in the ownership. Small, 3-5,000 acres in the East; 10-5,000 acres in the West. Medium, 5,000-50,000 acres. Large, 50,000 acres and larger.

3/ Operating area on an individual ownership is the combined area of the forest types, within an ownership, in which some recent cutting occurred. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Figures exclude operating area on some large ownerships to which access was denied.

4/ Less than 0.5 percent.

INTENSIFIED SURVEY ON WEST COAST

In order to show additional detail, and following consultation with foresters and others on the West Coast, a plan was completed to intensify the survey of recently cut lands there. The standard survey had already begun and field examiners were not required to re-examine areas already covered in order to obtain additional records. Therefore, the additional data needed for the intensified survey was not collected in six counties of northeastern Washington, one county west of the Cascades in that State, and one county in western Oregon. In California, over half the field work on the standard productivity survey had been completed so that additional information was collected on less than half of the area scheduled for examination. For this reason, results are presented only for the Pacific Northwest.[1/]

Collection of supplementary data began in March, 1954. The data collected in addition to that of the standard survey consisted of (a) the acreage cut over on the areas sampled, (b) reasons for nonstocking as observed by field examiners, (c) tally of species comprising stocking both before and after cutting in order to detect change, (d) whether partial or clear cutting methods had been used, (e) tally of felling ages to show proportion of cutover area by age classes. Aside from table 14, which presents statistics on commercial forest area, operating area, and area cut over in a single year by ownership classes, no attempt has been made to "blow up" or expand other data to obtain broad regional averages. Instead, results are expressed as percentages of the total number of sample points examined on recently cut lands within ownership classes, forest types, or combinations of these two.

Area Cut Over

The survey indicated that annual cutting during recent years approximates 630 thousand acres or 1.5 percent of the entire commercial forest area (table 14). However, careful examination of individual field tally sheets indicates that field instructions were not uniformly followed and that some field examiners failed to obtain full information on total area cut over on the larger private and public ownerships. In "blowing up" the data, a bias was thus introduced in final results which show low cutover area figures for large private and public lands.

Reasons for Nonstocking

Both the standard survey (table 74, Summary of Basic Statistics, Appendices) and recalculation of original stocking data on a sample point basis (table 15) show that in the Pacific Northwest stocking is poorest for all forest types on small private ownerships. The greatest deficiency occurs in the ponderosa pine type on small holdings. Here 33 percent of the points examined were not stocked and had no prospect of

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1/ After preliminary analysis of the additional field data taken in California, the Forest Service felt that results would not be sufficiently reliable for publication. However, copies of preliminary tabulations will be provided to those who have use for them.

Table 14.--Commercial forest area, operating area and estimated area cutover in one year in the Pacific Northwest 1/ by ownership class

PRIVATE HOLDINGS BY SIZE CLASS

Class of ownership	Commercial forest area	Operating area	Approximate area cut in one year 2/	Percent of total area cut in 1 year
	Thousand acres	Thousand acres	Thousand acres	
10-100 acres	2,004	627	80	4.0
100-500 acres	3,271	1,643	116	3.5
500-5,000 acres	3,058	2,095	105	3.4
Total, small private	8,333	4,365	301	3.6
5,000-50,000 acres	2,887	2,183	48	1.7
50,000 and larger	6,460	5,567	73	1.1
Total, all size classes	17,680	12,115	422	2.4

HOLDINGS BY TYPE OF OWNERSHIP

Class of ownership	Commercial forest area	Operating area	Approximate area cut in one year	Percent of total area cut in 1 year
Private:				
Farm	5,048	2,658	231	4.6
Lumber manufacturing	6,717	5,839	85	1.3
Pulp manufacturing	1,681	1,431	24	1.4
Other wood manufacturing	341	224	10	2.9
Other private	3,893	1,963	72	1.9
All private	17,680	12,115	422	2.4
Public:				
National forest	16,080	10,432	113	0.7
Bureau of Land Management	2,564	2,289	14	0.5
Indian	2,169	1,852	51	2.4
Other Federal	58	52	1	1.7
State	2,450	2,168	26	1.5
County and local	505	197	3	0.6
Total	23,826	16,990	208	0.9
Total, all ownerships	41,506	29,105	630	1.5

1/ Excludes area in northeastern Washington in U. S. Forest Service Region 1 that was not covered in the supplemental survey.

2/ Although estimated from the best data available these are, for most classes of ownership, approximations only. Based principally on 1947 for the western portion of the region and 1952 for the eastern portion.

Table 15.--Proportion of sample points not stocked and with no prospect of stocking, by forest type and ownership class, Pacific Northwest, 1954

Forest type group	Ownership class			
	Small private[1]	Medium and large private[2]	National forest[3]	Other public[4]
	Percent	Percent	Percent	Percent
Douglas-fir	27	24	11	20
Hemlock-Sitka spruce	17	14	8	12
Ponderosa pine	33	9	10	15
Other types	14	7	8	11

1/ Based on 17,807 points on 53,691 acres of cutover examined.
2/ Based on 12,807 points on 64,568 acres of cutover examined.
3/ Based on 9,908 points on 60,861 acres of cutover examined.
4/ Based on 12,536 points on 59,974 acres of cutover examined.

early stocking. In the Douglas-fir type, 27 percent on small private and 24 percent on medium and large private lands were also nonstocked.

In addition to the regular survey with respect to stocking on recent cutovers, the intensified survey attempted to identify the major reasons for nonstocking where this condition was found. For each nonstocked point, field examiners recorded their judgement as to probable reason for nonstocking. The results are summarized in table 16.

Most common cause for lack of stocking on cutovers in the Pacific Northwest was attributed to some form of ground cover. The proportion of nonstocking due to cull trees, brush, sod, and other ground cover varies from 58 percent in the ponderosa pine type to 85 percent in the "other" types. The greatest single cause of failure was brush cover in all but the ponderosa pine type where perennial sod was considered more important than brush.

Inadequate seed source is also important in the three major types. Especially critical from this standpoint is ponderosa pine where 30 percent of the unstocked points were charged to lack of seed source.

A surprisingly small proportion of the stocking failures was attributed to rodents and similar causes. Apparently rodent losses are not easily identified in this type of survey. It is probable that some nonstocking resulting from the eating or storing of seed by rodents may have been recorded as being caused by the more obvious factors such as the ground cover that harbors the rodents.

In any event, the steps needed to hold to a minimum the amount of unstocked and understocked cutovers in the Pacific Northwest involve principally the reduction of inhibiting ground cover and the improvement of the seed source, the latter especially in ponderosa pine.

Species Composition Changed by Cutting

Reduction in productivity ratings of the standard survey due to poor composition was smaller in the West than in the rest of the country, as shown by table 20 in a subsequent portion of this report. The Pacific Northwest rates at least as good in this respect as the average for the section. In the major forest types, the loss in rating due to composition was small (table 74, Summary of Basic Statistics, Appendices). The prior discussion of concepts for the standard productivity survey showed that composition on the ground was measured in comparison with standards appropriate for each type. The supplemental data on species composition for the Pacific Northwest was collected and tabulated under a different concept. Here the species constituting the stocking on the ground at the time of examination were recorded. In addition, field examiners were required to determine the species constituting the stocking prior to logging by examination of stumps and other available evidence. A comparison of the composition before and after logging was prepared from these two sets of records and is summarized in table 17. Data are presented separately for clear cuttings and partial cuttings.

Table 16.--Reasons for nonstocking on cutovers, by forest type group, Pacific Northwest, 1954

Reason for nonstocking	Forest type group			
	Douglas-fir 1/	Hemlock-Sitka spruce 2/	Ponderosa pine 3/	Other 4/
	Percent	Percent	Percent	Percent
Seed--inadequate source	14	15	30	6
Ground cover:				
Cull or noncommercial species	13	16	8	3
Brush	44	39	21	37
Perennial sod	8	5	24	21
Deep slash, logs, and stumps	9	12	5	24
Site conditions:				
Severe	4	4	5	2
Rock, water, roads, etc.	5	6	7	6
Other--rodents, animals, and other	3	3	(5/)	1
Total	100	100	100	100

1/ Based on 28,791 points on 83,767 acres of cutover examined.
2/ Based on 6,255 points on 24,226 acres of cutover examined.
3/ Based on 14,978 points on 120,469 acres of cutover examined.
4/ Based on 3,034 points on 10,632 acres of cutover examined.
5/ Less than 0.5 percent.

Table 17.--Composition of stocking[1] before and after cutting by ownership class and forest type group, Pacific Northwest, 1954

CLEAR-CUTTING

Forest type group and species	Small private ownership		Medium and large private ownership		National forest ownership		Other public ownership	
	Before cutting	After cutting	Before cutting	After cutting	Before cutting	After cutting	Before cutting	After cutting
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Douglas-fir:								
Douglas-fir	92	70	71	66	66	80	71	63
Hemlock	2	6	15	18	22	12	14	19
Western redcedar	2	5	10	8	8	3	8	7
White fir	(2/)	8	1	3	2	1	1	5
Other	4	11	3	5	2	4	6	6
Total	100	100	100	100	100	100	100	100
Ponderosa pine:								
Ponderosa pine	91	70	71	49	37	84	65	53
Douglas-fir	7	20	16	14	47	16	26	20
White fir	(2/)	1	13	37	16	(2/)	6	21
Other	2	9	(2/)	(2/)	(2/)	(2/)	3	6
Total	100	100	100	100	100	100	100	100
Hemlock-Sitka spruce:								
Hemlock	85	80	85	77	69	49	73	78
Sitka spruce	8	11	2	11	(2/)	1	5	5
Douglas-fir	3	2	3	3	12	37	3	3
Western redcedar	2	2	5	2	16	8	13	9
Other	2	5	5	7	3	5	6	5
Total	100	100	100	100	100	100	100	100

PARTIAL CUTTING

Forest type group and species	Small private: Before cutting	Small private: After cutting	Medium and large private: Before cutting	Medium and large private: After cutting	National forest: Before cutting	National forest: After cutting	Other public: Before cutting	Other public: After cutting
Douglas-fir:								
Douglas-fir	95	77	76	49	68	52	81	69
Hemlock	(2/)	3	2	4	9	13	1	5
Western redcedar	1	3	(2/)	1	4	6	5	8
White fir	1	1	6	12	3	9	3	3
Ponderosa pine	(2/)	8	11	17	5	11	4	5
Other	3	8	5	17	11	9	6	10
Total	100	100	100	100	100	100	100	100
Ponderosa pine:								
Ponderosa pine	91	85	73	64	81	79	85	73
Douglas-fir	9	12	22	21	6	10	13	18
White fir	(2/)	3	2	8	10	6	(2/)	6
Other	(2/)	(2/)	3	7	3	5	2	3
Total	100	100	100	100	100	100	100	100

1/ Based on points that were stocked both before and after cutting and on which a cut stump indicated that the point was affected by the cutting.

2/ Less than 0.5 percent.

In the Douglas-fir type group, on small private ownerships the representation of Douglas-fir on clear cuttings dropped from 92 percent before cutting to 70 percent after cutting. This change was accompanied by increases in the proportion of western hemlock and redcedar, white fir and other species. On medium and large private ownerships in this type group, the reduction of Douglas-fir was 5 percent. A slight reduction also was found in the proportion of western redcedar. Other species increased slightly. Similar changes took place on other public lands. On recently cut areas of the national forests, the representation of Douglas-fir increased from 66 percent before cutting to 80 percent after cutting. Associated species such as western hemlock and redcedar and white fir were reduced but a slight gain for other species was recorded.

Thus, for clear cuttings in the Douglas-fir type, the changes in species resulting from logging were a significant loss in the representation of Douglas-fir on small private ownerships accompanied by gains in the representation of other species, smaller losses in the proportions of Douglas-fir on medium and large private ownerships and other public lands, and substantial gains in the representation of Douglas-fir on the national forests.

Partial cutting in the Douglas-fir type groups resulted in substantial losses in the representation of Douglas-fir on all ownership classes. There were either increases or minor changes in the associated species.

On clear cuttings in the ponderosa pine type groups, the representation of ponderosa pine dropped over 20 percent on both size classes of private ownership. A smaller decrease was found on other public lands, but a large increase in the proportion of ponderosa pine was found on the very small portion of national forest area which was clear cut in this type group. On small private ownerships, the loss in representation of ponderosa pine after clear cutting was accompanied by an increase in Douglas-fir. However, on all other ownership classes, the proportion of Douglas-fir in the ponderosa pine type was reduced by clear cutting. White fir showed increases on medium and large private ownerships and on other public lands. The representation of white fir was reduced considerably on the very small area of national forest clear cuttings.

Partial cuttings in ponderosa pine type groups showed losses in the representation of ponderosa pine on recent cutovers of all ownership classes. Smallest losses occurred on national forest cuttings--greatest on other public lands. Douglas-fir increased slightly on all ownership classes except for those of the medium and large private ownerships. White fir increased slightly on all ownership classes except the national forests where a decrease was found. Other species where present increased slightly.

In the hemlock-Sitka spruce type groups, clear cutting was used so universally on all ownership classes that no adequate information can be presented for partial cuttings. On clear-cut areas, the proportion of hemlock was reduced on all private ownership classes and a large reduction occurred on recent cutovers of the national forests; the representation of hemlock increased somewhat on other public lands. The representation of Sitka spruce increased slightly or remained

unchanged. About the same situation was found to exist with respect to Douglas-fir except on national forest lands where an increase of 25 percent in age points in the representation of Douglas-fir took place. The proportion of western redcedar declined in all ownership classes except for small private ownerships where it remained unchanged. The representation of other species increased slightly on all ownerships except for other public lands where a minor decrease was found.

Clear Cutting Common in Most Types

Clear cutting is the predominant cutting method in the Douglas-fir and hemlock-Sitka spruce types on all ownerships, although this method is applied on only a little more than half of the Douglas-fir type group in national forest ownership (table 18). On small private lands ponderosa pine also is almost entirely clear cut, but on other ownerships partial cuts are generally made in this type. In the other types, the practice is to clear cut on private lands and partial cut on most of the public lands. It is significant to note that cutting on the small private ownerships is almost entirely clear cutting regardless of the forest type involved.

Proportion of Clear Cutting by Age Classes

Regeneration through clear cutting is an accepted silvicultural practice well adapted to the old-growth forests that are still common in the West. Unfortunately, it is not confined to these old-growth stands. Table 19 summarizes by ownership classes the ages at which clear cutting is being done in the three major type groups of the Pacific Northwest. These data show that for each forest type higher proportions of the young age classes are being clear cut on small private ownerships than on other ownership classes. The proportion of clear cutting in young age classes is lower on the medium and large private ownerships than on small ownerships. However, the proportion of clear cutting in young age classes is greater on these larger private lands than on the public lands.

The highest proportions of clear cutting in young age classes takes place in the Douglas-fir type, although substantial proportions also occur in hemlock-Sitka spruce.

Interpretations of the importance of clear cutting in these young stands will be found in the following sections of this report.

Table 18.--Proportion of cutting classed as clear cutting, by forest type and ownership group, Pacific Northwest, 1954

Forest type group	Ownership class			
	Small private[1/]	Medium and large private[2/]	National forest[3/]	Other public[4/]
	Percent	Percent	Percent	Percent
Douglas-fir	87	79	58	85
Hemlock-Sitka spruce	89	99	93	98
Ponderosa pine	96	23	([5/])	10
Other types	84	100	17	28

1/Based on 53,691 acres of cutover examined.
2/Based on 64,568 acres of cutover examined.
3/Based on 60,861 acres of cutover examined.
4/Based on 59,974 acres of cutover examined.
5/Less than 0.5 percent.

Table 19.--Proportion of clear cutting by age class and ownership class for three major forest types, Pacific Northwest, 1954

Age class (years)	Douglas-fir 1/				Ponderosa pine 2/		Hemlock-Sitka spruce 3/			
	Small private ownerships	Medium and large private ownerships	National forest	Other public	Small private ownerships	Medium and large private ownerships	Small private ownerships	Medium and large private ownerships	National forest	Other public
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
20 - 40	4	..	..	(4/)	..	(4/)	1	(4/)	..	..
40 - 60	23	6	(4/)	3	(4/)	..	12	5	(4/)	3
60 - 80	23	8	(4/)	4	3	..	15	5	2	7
80 - 100	18	10	4	12	5	1	38	17	4	11
100 - 120	4	5	3	4	3	1	10	10	2	5
120 - 160	8	13	10	17	23	13	9	18	22	18
160 - 200	14	10	17	28	19	20	9	23	26	20
200+	6	48	66	32	47	65	6	22	44	36
	100	100	100	100	100	100	100	100	100	100

1/ Based on 28,791 points on 83,767 acres of cutover examined.
2/ Based on 14,978 points on 120,469 acres of cutover examined. In the ponderosa pine type on public lands the amount of clear cutting encountered in the sample was too small to provide reliable figures by age classes for these lands.
3/ Based on 6,255 points on 24,226 acres of cutover examined.
4/ Less than 0.5 percent.

In the preceding pages, a general picture of the productivity of recently cut lands has been presented by size class and type of ownership, and the major variations related to geographical location, class of ownership and other factors have been explored. Next will be identified the key conditions on these recently cut lands responsible for failures to meet the standards for high productivity.

This will be accomplished by separate appraisal of the proportion of recently cut lands in the high productivity class when measured on the basis of each individual rating element. Thus, the proportion of recently cut lands in the high productivity class will be discussed when stocking only is considered. The effects of species composition and premature cutting in modifying the stocking rating will also be discussed separately. Table 20 and figure 6 present the pertinent statistics.

Also in figure 7 is summarized, by sections and ownership groups, the effects of each rating element on the proportion of recent cutovers in the high class. For example, figure 7 shows that 40 percent of recent cutovers on all small ownerships were found to be in the high productivity class. It shows further that the remaining 60 percent, which constitutes a deduction from a feasible 100 percent, consisted of 43 percent due to high stocking standards not being found. A deduction of 6 percent was due to the composition standard not being met and the remainder of 11 percent was due to premature cutting.

Stocking Poorest on Small Ownerships

Existing stocking as determined by the survey of recently cut land consists of crop trees left on the ground after cutting plus any which may have become established between the time cutting was completed and the date of examination by the survey. This interval varied from seven years to only a few months. However, most examinations were made on areas cut less than three years prior to the examination date. Frequently then, the field examination occurred at a time when stocking of new growth was incomplete and changing rapidly, especially on clear cuttings, even though conditions may have been favorable for establishment of a new crop. Thus any analysis of existing stocking alone could easily prove misleading with respect to future productivity on recently cut lands. After careful estimates of the prospects for further stocking are made and added to existing stockings, the resulting totals give a much better measure of the probable effect of stocking on growth following cutting.

Total stocking shows many significant variations and exerts the greatest influence of the several elements contributing to the combined productivity ratings.

On the basis of total stocking (existing plus prospective), 74 percent of recently cut lands in Continental United States meet high standards of stocking (table 20). However, there are marked differences between broad ownership classes. Little over half (57 percent) of the recently

Table 20.--Effect of rating elements on distribution of operating area[1] by productivity class, 1953
(United States and Coastal Alaska)

Section and ownership class[2]	Commercial forest area		Proportion of operating area by productivity class for -											
			Existing stocking only			Total stocking (Existing plus prospective stocking)			Stocking modified by composition			Stocking and composition modified by felling age[3]		
	Total	Operating[1]	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low
	Million acres	Million acres	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
North:														
Small private	117	23	54	30	16	73	19	8	61	27	12	50	33	17
Medium and large private	25	18	67	27	6	86	13	1	80	18	2	68	28	4
Public	32	23	60	35	5	91	9	(4/)	85	15	(4/)	84	16	(4/)
Total or average	174	64	60	31	9	83	14	3	75	20	5	67	26	7
South:														
Small private	128	44	32	34	34	48	33	19	45	34	21	34	37	29
Medium and large private	48	32	42	41	17	77	16	7	76	17	7	74	18	8
Public	17	12	48	43	9	90	9	1	88	10	2	86	12	2
Total or average	193	88	38	38	24	65	23	12	62	25	13	55	27	18
West:														
Small private	20	7	25	51	24	59	35	6	54	37	9	48	39	13
Medium and large private	20	15	51	39	10	83	16	1	78	18	4	78	17	5
Public	77	57	38	53	9	78	18	4	76	19	5	76	19	5
Total or average	117	79	39	50	11	77	19	4	75	21	4	74	21	5
Continental United States:														
Small private	265	74	38	35	27	57	29	14	51	32	17	40	36	24
Medium and large private	93	65	51	36	13	81	15	4	77	17	6	73	21	6
Public	126	92	45	47	8	83	15	2	80	17	3	79	17	4
Total or average	484	231	45	40	15	74	19	7	70	22	8	65	24	11
Coastal Alaska: Public	4	4	87	13	..	89	11	..	89	11	..	89	11	..
Total or average, all sections	488	235	45	40	15	74	19	7	70	22	8	65	24	11

1/ Operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. The figures exclude operating area on some large private ownerships to which access was denied.

2/ Size class of private ownerships based on total commercial forest area in the ownership. Small, 3-5,000 acres in the East; 10-5,000 acres in the West. Medium, 5,000-50,000 acres. Large, 50,000 acres or larger.

3/ Final combined rating.

4/ Less than 0.5 percent.

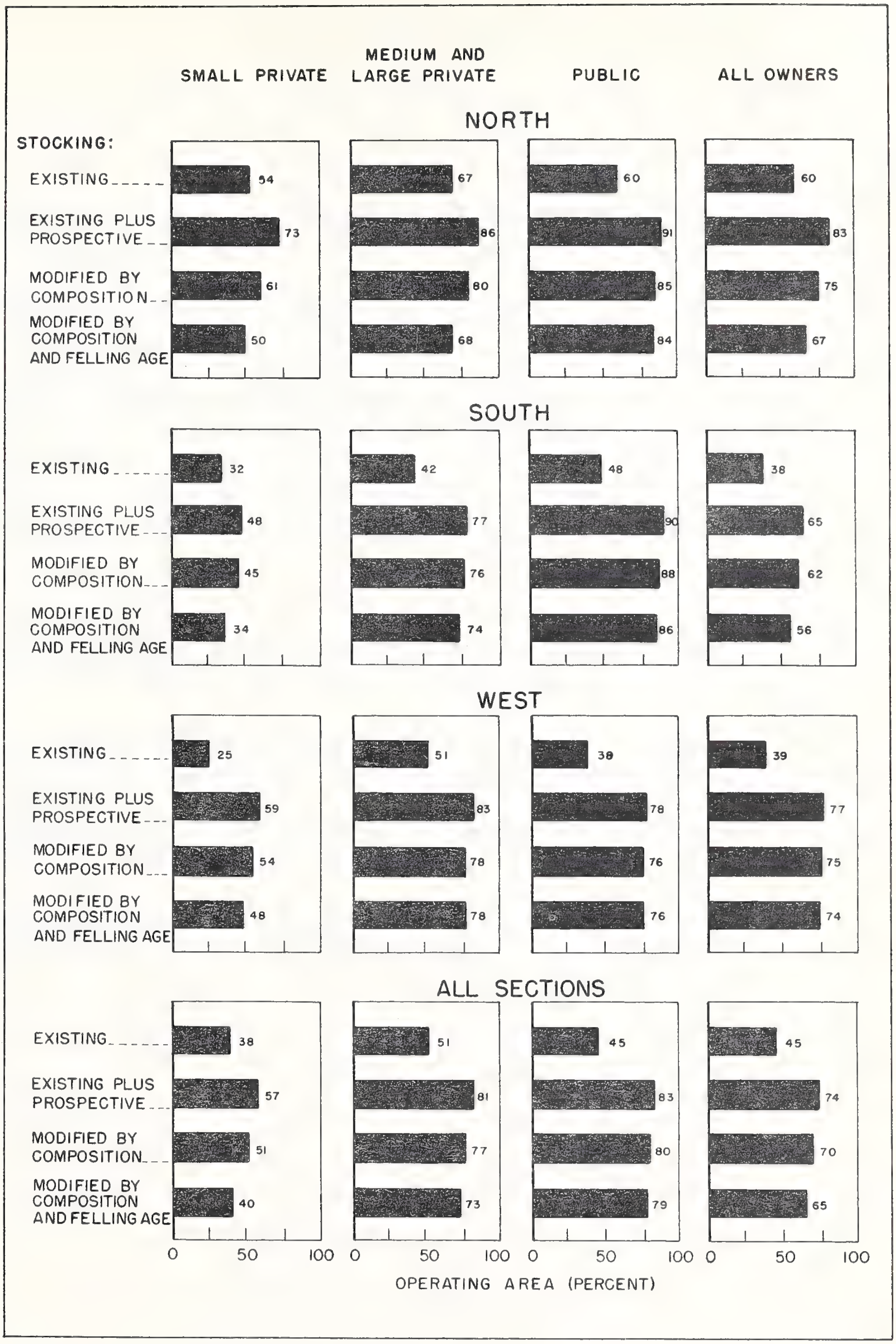


Fig. 6 - Relative effect of the rating elements on the proportion of operating area in the high productivity class, by section and ownership class, Continental U.S., 1953

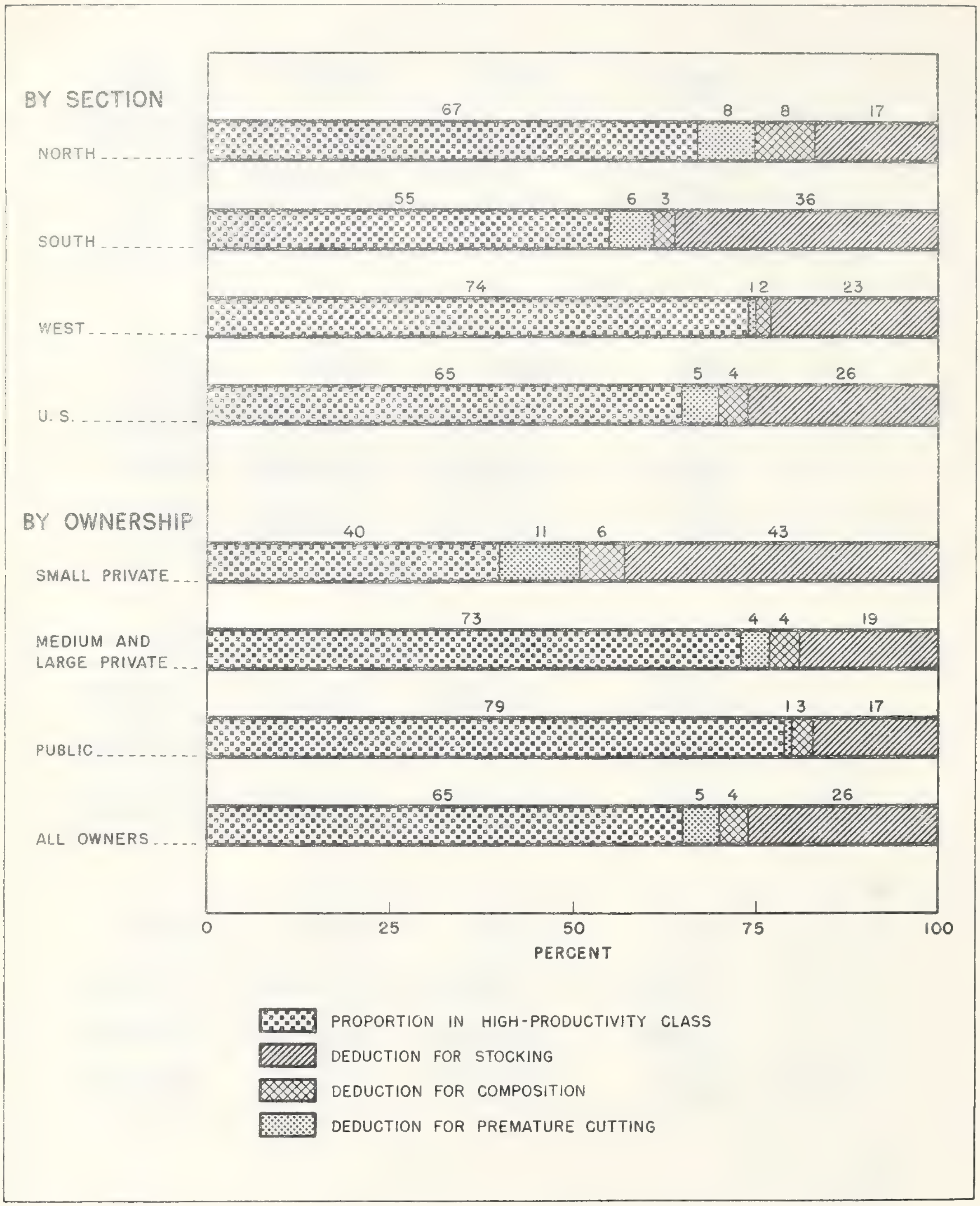


Fig. 7 – Percentage of recent cutovers in high productivity class, by section and ownership group, as affected by rating elements.

cut lands in small ownerships have attained high stocking standards as compared to slightly more than 80 percent for private owners of medium and large size and for public forests. The major stocking deficiencies on these small ownerships are in the South and West. Here the proportion qualifying for high stocking standards is substantially below the national average for all ownerships. Over 30 percent of all commercial forest lands are in the small ownerships of these two sections. Stocking on small ownerships of the North about equals the national average. This is partly due to the large proportion of hardwood types where establishment of reproduction is relatively easy.

Lack of Provision for Future Crops Responsible

Prospects of future stocking are much poorer for small ownerships than for other classes. Comparison of the data in table 20 for existing and total stocking shows that prospective stocking adds only 19 percentage points to the recently cut areas in small ownerships which meet high stocking standards. Comparable increases for other ownership classes equal or exceed 30 percentage points. Conditions on the ground after cutting which affect the establishment of new tree crops are, therefore, much less favorable on small private ownerships than on others. Corrective measures require a variety of positive actions. These vary widely by forest types, methods of cutting used, economic possibilities, and other factors. In some situations, only one or two simple changes may accomplish great improvement--in others a more complex combination of treatments is required.

Stocking Deficiencies Greatest in the South

The proportion of recently cut lands meeting high standards for total stocking is 83 percent in the North and 77 percent in the West. These proportions both exceed the national average of 74 percent. However, the score for total stocking in the South--65 percent--is considerably below the national average.

Recent cutovers on public lands in the South have met standards for high stocking as well or better than public lands elsewhere. The comparatively low rating in the South is due primarily to the conditions found on private lands and particularly on small private ownerships. Only 48 percent of recently cut lands in small southern ownerships met high standards for total stocking, the poorest stocking in the country. The fact that half of the operating area in the South was found to be in these small ownerships is primarily responsible for the low over-all stocking in this section. The proportion of recently cut lands meeting high stocking standards on medium and large private ownerships of the South exceeds the national average but is lower than for this class of ownership in either North or West.

Effects of Species Composition

In a previous discussion of concepts basic to the survey of recently cut lands, the standard of species composition adopted for each type was described. Application of this standard to the stocking rating results in a reduced rating if less than 50 percent of the stocking

consists of desirable species. In some cases, this reduction is great enough to drop the class rating from high to medium or even to low. In other cases, it may not be large enough to change the rating class. Thus, an individual rating of 85 for total stocking may drop to 75 when composition is considered, but the class rating still remains high since the range in ratings for this class is 70 to 100. The statistics of table 20, then, show the proportion of recently cut lands sufficiently affected by poor composition to be reduced from one rating class to another.

Table 20 shows that, nationally, 74 percent of recently cut lands meet high stocking standards. When the standard for species composition is applied, 70 percent of recently cut lands are found to be in the high class. Thus, 4 percent of all recently cut lands were lost from the high class because of poor composition.

This same comparison for each class of ownership in the three major sections of the country show some losses for all. The percentages of all recently cut lands which were lost from the high class because of failure to meet the composition standard were derived from table 20 and are summarized below:

Owner class	North	South	West	All regions
Small private	12	3	5	6
Medium and large private	6	1	5	4
Public	6	2	2	3
All ownerships	8	3	2	4

In general, except for small holdings in the North, relatively small proportions of recently cut lands were lost from the high class because of poor composition. However, the universal presence of this problem points to the danger of widespread, slow reduction in the proportion of desirable species on recently cutover lands.

Species Composition Poorest on Small Private Ownerships

Composition problems exist on all classes of ownership--both public and private. Nationally, the proportion of area affected on small private ownerships is nearly twice as great as on other ownerships--6 percent as compared to 4 percent for private lands of medium and large size, and 3 percent for public lands.

North Has Most Serious Problem

Geographically, the greatest losses of recently cut lands from the high productivity class because of poor composition occur in the North. The percentage of area lost here is four times the comparable proportion for the West and nearly three times that of the South. The high proportion of area in the hardwood types in the North (78 percent as compared to 47 percent in the South and 3 percent in the West--table 21, Summary of Basic Statistics, Appendices) helps explain this situation. Reduction of the proportion of recently cut lands in the high class

due to poor species composition is generally greater in hardwood than in softwood types (table 74, Summary of Basic Statistics, Appendices). This results from cutting the species of higher value and leaving on the ground those of lesser value. Repetition of this process gradually reduces the proportion of desirable species in a stand, and this is particularly serious in hardwood types which usually are characterized by a large number of species classed as commercial. A substantial number of these species have limited utility for wood products. Also, some forms of partial cutting of hardwoods are apt to favor the regeneration of shade tolerant species which often are not the most desirable. Softwood types were less affected by poor composition than hardwood types. This is due to the generally greater values of most softwood species which results in fewer situations where cutting can adversely affect composition.

Small private ownerships of the North are the most seriously affected by poor composition. Here 12 percent of recently cut lands were lost to the high class because of composition. This is twice the reduction on other ownerships of that section. In the West, reduction of area classified as high was 5 percent for small private ownerships and also for the larger private ownerships. This is over twice the reduction found on public lands of the West.

In the South, composition problems are again greatest on small private ownerships, least on medium and large private lands, with public lands occupying an intermediate position.

Premature Cutting Affects 30 Percent of Recently Cut Lands

The effect of felling age or premature cutting upon growth has been previously discussed as one of the basic elements for appraising the productivity of recently cutover lands. Reasons were presented to show how clear cutting of forest stands prior to attainment of peak growth reduces the amount of wood that can be grown despite good stocking and composition. The degree to which premature cutting limits growth in any area depends upon the prevalence of such cutting and the relative maturity of the clear-cut stands.

The prevalence of premature cutting is shown in table 21. The figures include all area where adjustments in the productivity rating were made for effects of felling age. All degrees of this effect, both large and small, are included.

Growth is being adversely affected to some degree by premature cutting on 29 percent of the recently cut lands in all regions combined. Over half of the recently cut area in small private ownerships is thus affected compared to 30 percent for medium and large private holdings and 9 percent for public lands. This concentration of premature cutting on small private ownerships, nationally, also occurs in the West and South, but in the North it is also important on private ownerships of medium and large size. Premature cutting on public ownerships is also more prevalent in the North than in other sections.

Table 21.--Proportion of operating area[1] on which premature cutting occurred, by section and region and by ownership class, 1953 (United States and Coastal Alaska)

Section and region	Ownership class[2]			
	Small private	Medium and large private	Public	All owners
	Percent	Percent	Percent	Percent
North:				
New England	83	81	38	78
Middle Atlantic	64	63	46	60
Lake States	25	13	18	19
Central	38	51	2	32
Plains	42	..	48	44
Average	51	63	21	44
South:				
South Atlantic	46	22	7	32
Southeast	59	17	6	37
West Gulf	68	26	3	41
Average	58	21	5	37
West:				
Pacific Northwest:				
Douglas-fir subregion	53	17	19	24
Pine subregion	56	2	3	9
Average	54	14	10	18
California	2	2	..	1
Northern Rocky Mtn.	42	9	3	6
Southern Rocky Mtn.	16	..	..	1
Average	44	10	4	9
Continental United States	54	30	9	30
Coastal Alaska	..	..	..	..
Average, all regions[3]	54	30	9	29

1/ Operating area of an individual ownership is the combined area of the forest types, in the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership.

2/ Size class of private ownership based on total commercial area in the ownership. Small, 3-5,000 acres in the East, 10-5,000 acres in the West. Medium, 5,000-50,000 acres. Large, 50,000 acres and larger.

3/ No premature cutting was revealed by the sample of recent cuttings in Coastal Alaska.

Among the various regions, those of the West show relatively limited prevalence, although in the Douglas-fir subregion of the Pacific Northwest this factor has reached substantial proportions as the second growth there comes into operable size. In all regions of the West except California, the proportion of recently cut lands affected by premature cutting is much greater on small private ownerships than on other ownership classes. In California, very little premature cutting was found and equal proportions occur in both size classes of private ownership.

The amount of premature cutting occurring in the western regions is small, due partly to the large proportion of commercial forest area in national forest and other public ownerships and a substantial portion of the larger private ownerships. The forest management policies of these ownerships aim to capture as much of the growth potential as possible. However, another factor responsible is the concentration of current cutting on mature or overmature stands which have reached or passed the age of peak annual growth. Here no opportunity exists for premature cutting. Because of the commitments to forest management policies on public and some private lands and the large proportions of commercial forest area in such ownerships, premature cutting will probably not become as prevalent in the West as elsewhere. Whether it will increase on other lands, after all old-growth timber is cut, to the extent now found in the North and South will depend upon the degree to which forest management policies are adopted on these other lands.

Among the regions of the North and South, premature cutting is most prevalent in New England (78 percent) and the Middle Atlantic States (60 percent), least prevalent in the Lake States (19 percent). A third or more of recently cut lands are affected to some degree by premature cutting in all other regions of the North and South.

Effects of Premature Cutting on Productivity

The discussion immediately preceding has shown the prevalence of premature cutting within the various sections, regions, and ownership classes of the country without regard to the effect on productivity. The last columns of table 20 show the degree to which premature cutting is reducing the proportion of recently cut lands in the high productivity class.

As previously noted, the proportion of recently cut land meeting high standards for stocking and composition was 70 percent for the country as a whole. When standards for rating the effect of felling age are also included, this percentage drops to 65. Thus, premature cutting is responsible for a loss of 5 percent in the area of all recently cut lands on which productivity was rated in the high class.

The percentages of recently cut area lost from the high productivity class because of premature cutting are summarized for each section and ownership class in the following tabulation:

Owner class	North	South	West	All regions
Small private	11	11	6	11
Medium and large private	12	2	0	4
Public	1	2	0	1
All ownerships	8	7	1	5

This shows that in the North where greatest productivity losses from premature cutting occur (8 percent in all ownerships) all classes of private lands contribute to the problem. In the South and West, losses are confined principally to small private ownerships.

A basic consideration in avoiding premature cutting is careful discrimination among second-growth stands of timber which have developed operable volumes of merchantable products. Within a given species or type there are stands, usually the younger, with still increasing volumes of annual growth. Often these can be harvested profitably. In contrast are similar stands, usually older, which have reached or nearly reached the age of greatest growth when little, if any, subsequent increase in growth can be expected. These can be operated profitably with greater recovery of volume than if cut at any earlier age. Premature cutting consists of clear cutting the first type of stand mentioned above before the peak of mean annual growth has been reached. Discrimination between these two broad types of second-growth stands and substitution of thinnings or other partial cuttings in those which have not completed their growth cycle would help to raise the national level of growth.

In passing, it should be noted that often a small amount of premature cutting is unavoidable or even of advantage to the long-range maintenance or improvement of growth. Individual logging units on large forests frequently cover considerable acreages and may contain small patches or stands of immature but operable timber. In some situations, such as mountainous areas mainly of old-growth timber, the methods of logging necessary are such that the small area of young stands cannot be reserved from cutting. Or they may pass the period of peak growth before another cut in the area is possible. In such cases, premature cutting is to be expected. A situation sometimes occurs where premature cutting is advantageous to maintenance of growth. This occurs where past fires of large size, rapid liquidation cutting, or a combination of both was followed by development of a single age class or very few age classes of young timber. Unless premature cutting is carefully done to develop a better distribution of age classes, large areas of timber will mature more rapidly than they can be harvested, with the result that in some species losses in yield due to overmaturity may equal or exceed those due to premature cutting. The aspen type of the Lake States is an example of this. Thus, a controlled amount of premature cutting has a definite and constructive part to play where long-range plans are aimed at attaining an ultimate balance of age classes for sustained yield of forest products. However, situations where premature cutting is beneficial in any sense are few and occur on only a small fraction of the recently cut lands in any of the three sections of the country.

Table 22.--Proportion of recently cut lands in the high productivity class and deductions for rating elements by ownership class and forest type group, 1953[1/]
(United States and Coastal Alaska)

Forest type group	Small private ownerships					Medium and large private ownerships					Public ownerships					All ownerships				
	Operating area	Proportion in high class	Deduction for: Stocking	Deduction for: Composition	Deduction for: Premature cutting	Operating area	Proportion in high class	Deduction for: Stocking	Deduction for: Composition	Deduction for: Premature cutting	Operating area	Proportion in high class	Deduction for: Stocking	Deduction for: Composition	Deduction for: Premature cutting	Operating area	Proportion in high class	Deduction for: Stocking	Deduction for: Composition	Deduction for: Premature cutting
	Million acres	Percent	Percent	Percent	Percent	Million acres	Percent	Percent	Percent	Percent	Million acres	Percent	Percent	Percent	Percent	Million acres	Percent	Percent	Percent	Percent
East:																				
White-red-jack pine	2.17	35	46	7	12	0.57	79	11	9	1	2.70	68	20	12	0	5.44	58	29	10	5
Spruce-fir	2.23	42	31	6	21	8.16	73	12	0	15	4.32	77	11	9	3	14.76	69	15	4	12
Loblolly-shortleaf pine	21.65	36	51	2	11	11.09	81	15	1	3	3.73	90	5	0	5	36.47	55	35	2	8
Longleaf-slash pine	7.63	29	61	1	9	12.07	75	24	1	0	2.71	93	5	2	0	22.41	62	34	1	3
Oak-pine	4.13	43	47	2	8	1.42	68	24	1	7	1.61	91	3	6	0	7.16	59	32	3	6
Oak-gum cypress	4.05	26	51	13	10	5.60	55	37	7	1	0.47	60	32	4	4	10.12	44	42	9	5
Oak-hickory	17.30	40	34	14	12	4.95	59	23	12	6	7.54	86	11	3	1	29.79	54	27	11	8
Elm-ash-cottonwood	.56	37	24	35	4	.02	100	0	0	0	.23	42	34	24	0	.81	40	26	31	3
Maple-beech-birch	5.37	67	14	8	11	5.83	71	9	12	8	4.73	94	4	2	0	15.93	76	9	8	7
Aspen-birch	1.65	74	26	0	0	.71	95	5	0	0	6.65	85	10	5	0	9.01	84	12	4	0
West:																				
Douglas-fir	3.69	56	36	2	6	5.39	83	15	1	1	14.02	79	20	1	0	23.10	77	21	1	1
Hemlock-Sitka spruce	.28	64	26	5	5	1.75	95	5	0	0	5.43	90	10	0	0	7.46	90	10	0	0
Redwood	.16	75	25	0	0	.72	90	10	0	0	.07	100	0	0	0	.95	88	12	0	0
Ponderosa pine	2.41	29	54	9	8	4.31	72	25	3	0	21.74	79	19	2	0	28.46	73	23	3	1
Western white pine	.17	27	73	0	0	.47	31	68	1	0	1.84	16	83	1	0	2.48	20	79	1	0
Lodgepole pine	.33	65	20	1	14	.36	96	4	0	0	8.28	90	8	2	0	8.97	89	8	2	1
Larch	.21	76	21	3	0	.68	34	7	59	0	2.71	42	52	6	0	3.60	43	41	16	0
Fir-spruce	.11	32	55	13	0	.85	88	12	0	0	6.60	72	26	2	0	7.56	73	25	2	0
Hardwoods	.02	50	27	23	0	..	..	..	..	..	.38	77	23	0	0	.40	75	24	1	0
All types	74.17	40	43	6	11	64.95	73	19	4	4	95.76	80	16	3	1	234.88	65	26	4	5

1/ Computed from Table 74, p. 112, Chapt. IX, Sec. A, SUMMARY OF BASIC STATISTICS. Figures show the deductions in proportion of area in the high class due to standards for each rating element not being met. For example, table 74 of the Basic Statistics shows that 54 percent of recently cut lands in the white-red-jack pine type group on small private ownerships met high-stocking standards. Thus, 46 percent of such lands did not meet such standards and is the deduction. Further, table 74 shows that when effects of composition were considered, the proportion of area in the high-productivity class changed from 54 percent to 47 percent, a loss of 7 percent in the area of high productivity due to failure to meet compositon standards. When premature cutting was considered, the proportion of area in the high-productivity class changed from 47 percent to 35 percent, a loss of 12 percent due to premature cutting. These losses or deductions allow direct comparisons of the relative importance of the elements by forest type groups and ownership classes.

Study by Forest Type Groups Further Identifies Deficiencies

The foregoing discussion helps define the geographic areas, ownership classes, and conditions of recently cut lands responsible for limiting the national level of growth insofar as timber cutting is concerned. This can be sharpened considerably by consideration of forest type in addition to the factor of ownership class and productivity elements.

Statistics of table 22 provide the basis for comparing the proportions of recently cutover lands in the high productivity class for each forest type group with the national average. These statistics also provide by type groups a basis for appraising the effect of each rating element on the proportion of cutovers in the high class. Such appraisals can also be made by broad ownership groups.

Softwood Types of East and West Contrast Sharply

In the tabulation appearing below, productivity on recent cutovers for each type group is compared to the national average by summary of data from table 22. The area of commercial forest land in each type is also shown (from table 21, Summary of Basic Statistics). The tabulation follows:

Forest type groups with proportions of recent cutovers in the high class exceeding the national average (over 70 percent)

Forest type group	Total area of type group[1/] (million acres)	Proportion of all commercial forest area (percent)
Eastern hardwoods:		
Maple-beech-birch	33.45	6.8
Aspen-birch	23.45	4.8
Total	56.90	11.6
Western softwoods:		
Douglas-fir	31.73	6.5
Hemlock-spruce	7.81	1.6
Redwood	1.59	0.3
Ponderosa pine	37.46	7.7
Lodgepole pine	14.47	3.0
Fir-spruce	13.62	2.8
Total	106.68	21.9
Western hardwoods	3.94	0.8
Total	167.52	34.3

Forest type groups with proportions of recent cutovers in the high class approximating the national average (60-70 percent)

Forest type group	Total area of type group (million acres)	Proportion of all commercial forest area (percent)
Eastern softwoods:		
Spruce-fir	21.46	4.4
Longleaf-slash pine	26.49	5.4
Total	47.95	9.8

Forest type groups with proportions of recent cutovers in the high class below the national average (under 60 percent)

Forest type group	Total area of type group (million acres)	Proportion of all commercial forest area (percent)
Eastern softwoods:		
White-red-jack pine	10.30	2.1
Loblolly-shortleaf pine	58.51	12.0
Total	68.81	14.1
Eastern mixed types:		
Oak-pine	22.89	4.7
Oak-gum-cypress	40.29	8.3
Total	63.18	13.0
Eastern hardwoods:		
Oak-hickory	112.21	23.1
Elm-ash-cottonwood	18.28	3.7
Total	130.49	26.8
Western softwoods:		
Western white pine	5.38	1.1
Larch	4.42	0.9
Total	9.80	2.0
Total	272.28	55.9

1/ The total of all type group areas falls short of the total commercial forest area by the acreage in the piñon-juniper type of the West in which no recently cutover lands were examined.

The first part of this tabulation shows that the nine type groups with cutovers exceeding the national average in productivity contains about one-third of all commercial forest land in the United States. The strongest component consists of six western forest type groups. Their total area is about twice that of the maple-beech-birch and aspen-birch type groups which are the only two eastern types whose recent cutovers exceed the national productivity average. The absence of eastern softwood types is noteworthy. Only two western softwood types did not qualify for this category.

Two eastern softwood types--spruce-fir and longleaf-slash pine--are the only ones with recent cutovers approximating the national productivity average. Together they comprise nearly 10 percent of all commercial forest land in the country. Both are highly important types in the sections where they occur.

The recent cutovers of all other eastern softwood and mixed hardwood-softwood types are below the national productivity average and constitute major weak spots. The loblolly-shortleaf pine type group is the largest softwood type in the country and is included in this category. Eastern types producing softwoods and which have cutover lands with productivity below the national average contain 27 percent of all commercial forest land. In addition to these, two western type groups--western white pine and larch--are also weak spots. Together they occupy 2 percent of all commercial forest land.

Softwoods supply the highest proportion of our annual timber cut from growing stock. During 1952, in all regions, the cut of softwoods from living trees five inches or more in diameter was 7.5 billion cubic feet or 69 percent of the 10.8 billion cubic foot total (table 49, Summary of Basic Statistics). In view of their current importance and the tight softwood supply situation projected for the future in Chapter VII, the absence of eastern softwood types in the better-than-average category is of considerable national significance.

Hardwood Types of Largest Area Have Cutovers Below Average in Productivity

The oak-hickory and elm-ash-cottonwood type groups constitute the major weaknesses in hardwoods. Their combined area comprises 27 percent of all commercial forest land. The oak-hickory group with its many important subtypes covers more commercial forest land (112 million acres) than any other type group. It is widely distributed over both the North and the South, as is the smaller elm-ash-cottonwood group. The combined area of these two type groups (130 million acres) is over twice as large as the combined area of the maple-beech-birch and aspen-birch types on which productivity of cutovers exceeds the national average.

Weak Spots by Forest Type Groups Identified by Rating Element and Ownership Class

In table 22, the "deductions" for each type groups and ownership class represent the proportion of recently cut lands which did not qualify for the standards set up in the Criteria. For example, table 22 shows that 35 percent of recently cut lands of the white-red-jack pine type on small ownerships met all standards of the Criteria sufficiently well to qualify for the high productivity class. The "deductions" show that 46 percent of recently cut lands did not qualify for the high class because stocking standards were not reached. Seven percent of the area of recently cut lands were lost to the high class because the composition standard was not reached, and another 12 percent was lost due to premature cutting. The sum of the "deductions" and the proportion of area in the high productivity class always equals 100, thus accounting for all recently cut land in each forest-type owner class combination.

The deduction of 46 percent because of stocking in the white-red-jack pine type in small ownerships is greater than the average stocking deduction for all types on all ownerships (26 percent). Thus, stocking in this type on small private ownerships is deficient in comparison with average stocking countrywide, and this tends to hold down or place limitations on the national level of growth. All such comparisons from table 22 were used as the basis for identifying weak spots in table 23. The major weak spots are shown in figure 8.

Stocking Deficiencies Mainly in Softwood Types on Small Ownerships

The summarized figures in table 23 reaffirm a previous finding that stocking on small private ownerships is a major reason why the recently cut lands on such ownerships are below the national average in productivity. They show further that the stocking deficiencies of small ownerships are concentrated on 12 forest type groups. Eight of these are softwood type groups, two are mixed hardwood-softwood and two are hardwood groups. The eight softwood type groups consist of all four eastern softwood types and the western white pine, fir-spruce, ponderosa pine, and Douglas-fir types of the West. Both of the mixed softwood-hardwood type groups of the East are deficient in stocking on small ownerships. Of the hardwood type groups, oak-hickory and western hardwoods show stocking deficiencies on these ownerships.

Deductions show that stocking deficiencies are usually greater for softwood than for hardwood type groups and that such deficiencies are slightly greater in western softwood than eastern softwood types on small ownerships.

Four type groups show stocking deficiencies in the larger private and public ownerships combined. Two of these, western white pine and oak-gum cypress are deficient in stocking on both of these ownership groups. The western larch and elm-ash-cottonwood types show stocking deficiencies on public lands only.

Table 23.--Proportion of recently cut lands in the high productivity class and deductions for rating elements by ownership class and forest type group where such deductions exceed the national average deduction for each element,1/ 1953

(United States and Coastal Alaska)

Forest type group	Small private ownerships				Medium and large private ownerships				Public ownerships			
	Proportion in high class	Deduction for -			Proportion in high class	Deduction for -			Proportion in high class	Deduction for -		
		Stocking	Composition	Premature cutting		Stocking	Composition	Premature cutting		Stocking	Composition	Premature cutting
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Eastern softwood:												
White-red-jack pine	35	46	7	12	79	..	9	..	68	..	12	..
Spruce-fir	42	31	6	21	73	..	..	15	77	..	9	..
Loblolly-shortleaf pine	36	51	..	11	81	..	..	..	90	..	..	..
Longleaf-slash pine	29	61	..	9	75	..	..	..	93	..	..	..
Eastern mixed softwood-hardwood:												
Oak-pine	43	47	..	8	68	..	..	7	91	..	6	..
Oak-gum-cypress	26	51	13	10	55	37	7	..	60	32	..	..
Eastern hardwood:												
Oak-hickory	40	34	14	12	59	..	12	6	85	..	..	..
Maple-beech-birch	67	..	8	11	71	..	12	8	94	..	..	..
Elm-ash-cottonwood	37	..	35	..	100	..	..	..	42	34	24	..
Aspen-birch	74	..	..	..	95	..	..	..	85	..	5	..
Western type groups:												
Douglas-fir	56	36	..	6	83	..	..	..	79	..	..	..
Hemlock-Sitka spruce	64	..	5	..	95	..	..	..	90	..	..	..
Redwood	75	..	..	..	90	..	..	..	100	..	..	..
Ponderosa pine	29	54	9	8	72	..	..	..	79	..	..	..
Western white pine	27	73	..	..	31	68	..	..	16	83	..	..
Lodgepole pine	65	..	..	14	96	..	..	..	90	..	..	..
Larch	76	..	..	..	34	..	59	..	42	52	6	..
Fir-spruce	32	55	13	..	88	..	..	..	72	..	..	..
Hardwoods	50	27	23	..	..	..	..	..	77	..	..	..

1/ National-average deductions for rating elements are: Stocking, 26 percent; composition, 4 percent; premature cutting, 5 percent. No entry means that deductions were less than these national averages.

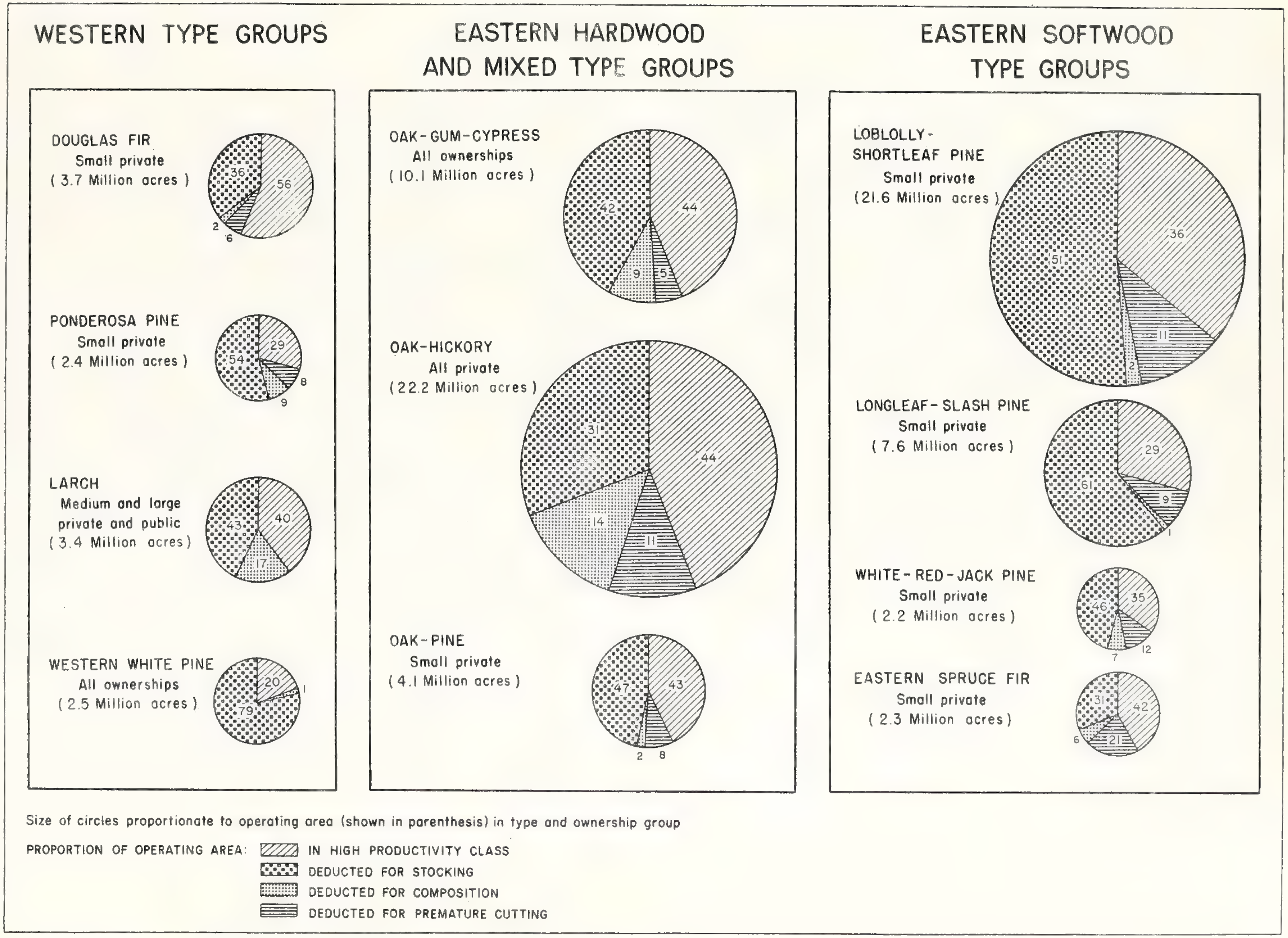


Fig. 8 - Major weak spots in productivity of recently cut lands by forest type group, ownership class and rating element

The western white pine type requires special consideration. Although covering a comparatively restricted area, the high value of this species and the specialized products derived from it makes this species of much greater importance than its limited distribution would imply. Stocking deficiencies are related primarily to the serious nature of the white pine blister rust. Control of this disease requires special cutting methods on ownerships attempting long-term management of western white pine, particularly the national forests. The cutting methods adopted consist of a series of partial cuts spaced some years apart which stimulate germination of the wild currant and gooseberry plants, that serve as alternate hosts for the blister rust, but at the same time provide sufficient shade and other environmental conditions to decimate them after germination. By thus reducing the population of the rust's alternate host, the ultimate costs of digging, poisoning, or otherwise removing these plants is much lower than if the overmature areas scheduled for cutting first were immediately clear cut and regenerated either naturally or by planting. The necessary shade to provide this decimating effect on the alternate host is provided primarily by species associated with white pine, such as hemlock and grand fir, which are often highly defective and unmerchantable on current markets. However, possibilities of an early demand for these species as pulpwood appear good. Sales for this purpose would accomplish removal of these species more economically than burning them over. Unfortunately, the biology of the situation is such that the shade necessary to reduce direct blister-rust control costs prevents prompt natural regeneration of white pine.

The long-term policy of managing western white pine on the national forests, therefore, is unavoidably to hold recently cut areas in a state of limited productivity for a period of years in order to later realize greater returns from a reduced investment in direct control of blister rust.

In contrast to this policy, most private owners are not committed to a similar long-term policy of growing western white pine. Some of these private lands receive the benefits of direct blister-rust control programs, but a large proportion of the white pine type on private lands is not included in this program. Here conversion of the white pine type to other species not susceptible to blister rust appears as the only solution, and in this situation these substitute species have been recognized in the rating criteria as desirable in the stocking of recently cut lands. Thus, on recently cut national forest lands in blister-rust protection areas, deficiencies in stocking relate to current deficiencies in the stocking of white pine while outside protection zones, including most private land, stocking deficiencies relate primarily to species other than white pine.

Composition Deficiencies Less Concentrated Than Stocking Deficiencies

Composition deficiencies affect a wider variety of types on all ownership classes than did stocking deficiencies. However, more types are affected by this element on small private than on other ownership classes. On these small properties, there are ten type groups deficient

in composition. Four of these are hardwood types, five are softwood, and one is the eastern mixed type group, oak-gum-cypress.

Deductions show that composition deficiencies are usually greater on small private ownerships for hardwood than for softwood types. An exception is the maple-beech-birch type group. Among the softwood groups, two western types, fir-spruce and ponderosa pine, show somewhat higher deductions for composition than do the two eastern types, white-red-jack pine and spruce-fir. However, the hemlock-Sitka spruce type of the West shows the smallest reduction of all the types which are deficient in composition on small ownerships.

On the larger private ownerships, five type groups are deficient in composition and of these four are eastern type groups. Two are important eastern hardwood types, one is the white-red-jack pine type, and the fourth is oak-gum-cypress of the South. The only western type with composition deficiencies on medium and large private ownerships is the larch type group.

Six type groups are deficient in composition on public ownerships. Two are eastern softwoods found mostly in the North. They are white-red-jack pine and spruce-fir. The other softwood type is western larch. Of the remaining three type groups, one is a hardwood type of the North, aspen-birch, and the last two, elm-ash-cottonwood and oak-pine, are distributed generally in the East.

The absence of composition deficiencies in pine types of the South warrants special comment in view of discussion in other chapters of this report regarding the softwood area in the South which has been replaced by hardwoods. There are two reasons why stocking deficiencies for southern pine types do not appear in table 23. First, the standards for rating composition in several of the southern subtypes recognize the better hardwoods as desirable species along with the softwoods. In these subtypes, a replacement of softwoods by the better hardwoods could take place without change in a rating for composition. Second, table 23 shows only the deficiencies which exceeded the average deficiencies for the Nation as a whole. Absence of any entries for composition for southern pine types means that any such deficiencies present did not exceed the national average. Table 22 shows that some deductions due to composition were present in all southern types, whether softwood or mixed softwood-hardwood types, and that the small percentage deductions for composition applied to the large operating area in these types involves substantial areas on which composition standards were not met after cutting.

Premature Cutting Mainly Affects Eastern Type Groups on Small Ownerships

Eleven type groups show deficiencies due to premature cutting. Eight of these are native to the East. Premature cutting is responsible for deficiencies in all eleven type groups on small ownerships.

Generally, on small ownerships, the eastern softwood types show greater deficiencies due to premature cutting than do the western softwood types.

An exception is lodgepole pine which is second only to the eastern spruce-fir type in order of deficiencies due to premature cutting.

Four of the type groups identified with small ownerships also show deficiencies due to premature cutting on the larger private ownerships. All are eastern type groups. Of these, the greatest deficiency is in the spruce-fir type. Others which have about equal deficiency are maple-beech-birch, oak-pine, and oak-hickory.

Deficiencies due to premature cutting do not appear on public lands.

SUMMARY

The major results of the survey of recently cut lands are as follows:

1. Nationally, 56 percent of the recently cut lands in private ownership and 80 percent of those in public ownership were found to be in the upper productivity class. About three-fourths of all commercial forest land is in private ownership.

2. Recently cut lands on public ownerships and on the ownerships of wood-manufacturing industries are at about the same general level of productivity. The proportions of these lands in the upper productivity class by ownership groups are: Pulp industry--84 percent, national forests--81 percent, other public ownerships--77 percent, lumber and other wood-using industries--73 percent.

3. In contrast, the proportions of recently cut lands in the upper productivity class were much lower on farm and other private forest lands. The proportions were: Farm--41 percent, other private--52 percent.

4. The national significance of this contrast is emphasized by the area of commercial forest land in these two broad ownership groups. About 193 million acres or 39 percent of all commercial forest land is found on ownerships of the public and of the wood-using industries, while 296 million acres or 61 percent of the total is in farm and other private ownership.

5. Condition of recent cutovers is closely related to size of private ownerships. Proportions of recently cut lands in the upper productivity class were: Small private--40 percent, medium private--64 percent, and large private--78 percent. Public lands taken together showed 80 percent of recently cut lands in the upper productivity class. Small private forest ownerships are largely on farms and on other private lands. Together these numerous small properties contain 265 million acres or 54 percent of all commercial forest land.

6. The condition of recently cutover lands is poorest in the South and best in the West. The position of the South is due to the very large area (128 million acres) of small private ownerships on which only one-third of recently cut lands were found to be in the upper productivity class. The commercial forest area in these small southern ownerships comprises 26 percent of all such area in the country and exceeds the entire commercial forest area of the West, the entire national ownership of the wood-manufacturing industries, and also of the national forests.

7. Although both clear cutting and partial cutting methods have a useful place in keeping recently cut lands productive, clear cutting methods as now applied result in a generally lower level of productivity than do partial cuttings. Important exceptions to this general relation exist particularly in the West.

8. On 65 percent of all recently cut lands, the cutting was made primarily for large products such as sawlogs, veneer logs, and piling. Only 15 percent of the area was cut primarily for products of small size such as fence posts and cordwood for pulp or fuel. Integrated utilization was practiced on the remaining 20 percent, i.e., products of both broad size classes were removed. The productivity of recently cut lands was higher where integrated utilization was practiced than where either large or small products were the primary objective of cutting. This difference in productivity is most pronounced on private lands of medium and large size, least pronounced on small private ownerships.

9. An intensified survey in the Pacific Northwest showed that the most common cause of nonstocking on recent cutovers was judged to be some form of ground cover. Second in importance were inadequate sources of seed for natural regeneration. Marked changes in species composition were also found to result from cutting and these changes varied considerably between types of ownership.

   Clear cutting was found to be the prevailing type of cutting in all forest types on all ownership classes in the Pacific Northwest, except for the ponderosa pine type where partial cutting was the most common practice on medium and large private ownerships and on the public lands. Greater proportions of the clear cutting on small private ownerships was found in the younger age classes of second-growth Douglas-fir and hemlock-Sitka spruce than was found on lands of other ownerships.

10. Comparison of the proportions of recently cutover lands in the upper productivity class with the national average in this class identifies the following weak and strong spots in the cutover area picture:

Type of ownership	Proportion of all commercial forest land in ownerships on which productivity of recent cutovers is: Below the national average (percent)	Above the national average (percent)
Private:		
Farm	31.1	..
Other private	17.8	3.6
Wood-manufacturing industries	2.3	7.9
Public:		
National forest	..	13.0
All other Federal	0.9	2.1
State and local	0.7	4.6
Total	52.8	31.2

Farm and other private forest ownerships on which recently cut lands are below the national average in productivity contain 49 percent of all commercial forest land or about 240 million acres. This area consists, for the most part, of nearly 4.5 million small private ownerships.

11. The more important conditions adversely affecting productivity of recently cutover lands are:
    (a) Deficiencies in stocking on small private holdings in all sections for nearly all of the more important forest type groups, and particularly deficiencies in conditions favorable for establishment of new trees after clear cutting.
    (b) Deficiencies due to poor composition in all sections and ownerships for some of the more important forest type groups, but particularly on small private ownerships in the North. Deficient composition in the North is related to the large proportion of hardwood types and the wide variation in utility of the many species in such types.
    (c) Deficiencies due to premature cutting on small private ownerships in all sections and also on medium and large private ownerships in the North.

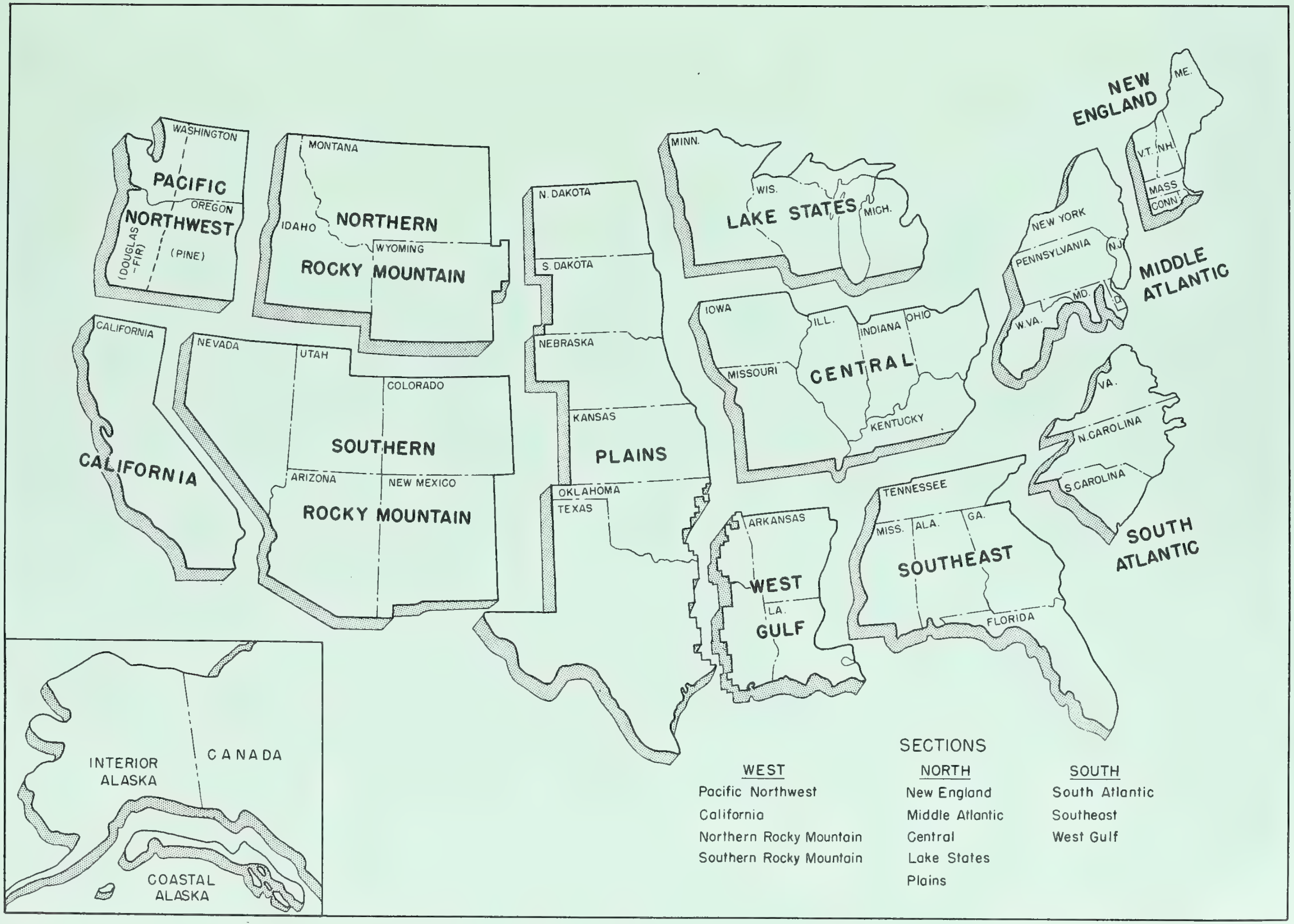
12. Productivity of recently cutover lands varies significantly among major forest type groups.

    Type groups with recent cutovers having more than the national average of their recently cut area in the upper productivity class include all the forest types of the West except western white pine and larch. In contrast, they include only two eastern groups: Maple-beech-birch and aspen-birch.

    Type groups with recent cutovers falling below the national average in proportion of area in the upper productivity class include all eastern types except the two mentioned above, but only the western white pine and larch types of the West.

    In addition to this broad type classification, significant deficiencies appear in segments of some type groups which are above or approximate the national average. In particular, major deficiencies must be noted for small ownerships in the Douglas-fir, ponderosa pine, longleaf-slash pine, and eastern spruce-fir type groups.

13. The adverse conditions and deficient types outlined in items 11 and 12 are those tending to hold down the level of growth on recently cutover lands. They identify the major opportunities which exist for increasing growth and point out where efforts may best be concentrated.



Regions and Sections used in the Timber Resource Review

TIMBER RESOURCE REVIEW

CHAPTER IV
FACTORS AFFECTING FUTURE SUPPLY AND QUALITY OF DOMESTIC TIMBER

C. FOREST TREE PLANTING

(Preliminary Review Draft Subject To Revision)

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

CHAPTER IV. F A C T O R S A F F E C T I N G F U T U R E S U P P L Y A N D Q U A L I T Y O F D O M E S T I C T I M B E R

C. FOREST TREE PLANTING

(Preliminary review draft subject to revision)

By:

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Roland Rotty

September, 1955

Contents

FOREST TREE PLANTING

One of the most unfavorable features of the forest situation nationally is the extent of understocked area. Nearly 70 million acres, or 14 percent of the commercial forest area, is poorly stocked or deforested. While obviously a problem of considerable magnitude, the opportunity and challenge in building up timber production by restoring these understocked lands to higher productivity is likewise apparent. How far we progress will depend in large part upon the energy and the success of efforts to regenerate them artificially. This means, simply, planting the large proportion of this idle acreage which is capable of growing economic crops of timber.

Planting can augment timber production in a number of ways. It can increase the productive acreage by restocking lands now lying idle and reduce such waste in the future. It can raise the productivity of understocked lands through interplanting. It can improve forest growth and quality by the use of superior planting stock.

Because of its potential impact upon future timber production, it seems appropriate to round out the timber resource picture by presenting the status of planting on forest lands of the United States and to give a considered estimate of anticipated future trends.[1] That, briefly, is the purpose of this analysis.

OBJECTIVES AND PROCEDURES OF THE PLANTING APPRAISAL

An Effort to Determine and Interpret the Present Situation in Planting

More specifically, the planting phase of the Timber Resource Review was designed to determine: (1) the accomplishments in planting so far, including the acreage of plantations now in existence and the success of past planting effort; (2) the area of nonstocked or poorly stocked forest land in the United States which would lend itself to planting; (3) past trends and probable future trends in artificial restocking; and (4) the adequacy of nursery facilities now and for future needs.

In analyzing and interpreting available data, the national picture was brought into focus, regional differences were noted, and comparisons were made between broad classes of ownership. Possible future developments were suggested in the light of the present situation. They are, of course, speculative. However, reasonable projections of the past into the future should give some idea of what lies ahead.

Information Gathered from Many Sources

The estimates of past planting accomplishments, area available for planting, and planting trends given here represent the best information

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1/ Since planting is of only minor consequence in Coastal Alaska, this discussion is confined to the continental United States.

available from numerous sources. Data from the Forest Survey, past reports from State Foresters, existing planting surveys in some States, and material from other agencies were consolidated into State and regional estimates. These estimates were in turn checked by task groups of Forest Service specialists with the aid of forestry personnel from many States. Adjustments were made on the basis of knowledge of the local situation. No specific field sampling of plantations on the ground was undertaken.

Concepts Underlying the Study

To insure understanding of this analysis of planting, definitions of certain key terms and explanations of concepts basic to the discussion are introduced below:

Planting - The establishment of a tree cover (and/or a shrub cover in the case of shelterbelts) by the planting of nursery stock or by direct seeding. Open area planting is planting of nonstocked forest areas or of nonforest area. Interplanting is planting of forest areas which are poorly stocked (not over 10 percent) with trees.

The planting estimates given here provide for areas of failure of natural restocking which require planting. They do not include artificial regeneration practiced in lieu of natural restocking. Neither do planting projections include planting on areas of low stocking but with more than 10 percent covered by trees. Replanting soon after harvest cutting instead of relying on natural regeneration is growing in favor. To the extent that these two latter types of reforestation will be practiced, the planting projections presented in this report are conservative.

There are several directions which planting might take in the years ahead which would alter the current picture. The forest manager of the near future will be faced with such questions as: (1) should he plant for quick regeneration, rather than wait even as short a period as three to five years for natural restocking; (2) how long should he wait for natural regeneration before he decides to plant; (3) should he plant only where natural regeneration will be delayed beyond reason? Of course, the answers to these and many other questions in similar vein will vary from property to property and no general prescription will suffice. Nevertheless, they are real issues in timber production and must eventually be resolved for each situation.

Plantation - An area on which a tree cover (and/or a shrub cover in the case of shelterbelts) has been established by planting. In the case of interplanting, the plantation acreage is not the gross area interplanted but the net area on which planting actually occurs. For example, at 1,000 trees per acre, interplanting of 11,000 trees would be equivalent to 11 acres of plantation.

Acceptable plantation - For a plantation to be classed as acceptable it was required to have at the end of the fifth year after planting the following number of planted trees per plantation acre: Engelmann spruce and lodgepole pine, 300; other western species, 200; all eastern species, 400.

Planting success - The area of acceptable plantations divided by the total area planted. For example, with 1,000,000 acres planted in a given area and 750,000 acres in acceptable plantations at time of the 1952 estimate, the success would be 75 percent.

Plantable area - Nonstocked or poorly stocked forest land or nonforest land on which: (1) the establishment or interplanting of forest tree cover is desirable and practical, and (2) regeneration will not occur naturally to a desirable density within a reasonable time. This study is a physical appraisal of the area which could be planted practically and does not attempt to incorporate business aspects in the analysis. It does not suggest that it is economically feasible to plant all plantable area.

Obviously, some of the acreage cutover during the period of rating, 1947 to 1952, will fall into the category of plantable area. However, the chief problem is the huge backlog of deforested and understocked forest land built up over the years. This backlog is the major subject of the report.

Total plantable area - A term employed in this report to express the entire acreage available at the time planting started, as reconstructed in 1952. It is obtained by adding the area of acceptable plantations in 1952 to the plantable area remaining at that time.

Natural reduction in plantable area - The gradual decrease in plantable area through natural seeding. As used in this discussion, it is a net reduction, with accretions to nonstocked or poorly-stocked land taken into account.

STATUS OF PLANTING ON COMMERCIAL FOREST LAND

Past Accomplishments in Planting

Planting began early in the history of this country, probably close on the heels of the first land clearing. There are records of oak plantings for the production of ship timbers in the 1740's. It is known that several hundred acres of plantations were established in eastern Massachusetts in the 1840's.

Planting for a long time has held in conservation a respected position akin to that of fire protection. As a consequence, reforestation efforts gradually built up over the years, both by private owners and Government agencies. By 1926 it is estimated that 352 thousand acres of acceptable plantations had been established on commercial forest land. Early planting was attempted with little knowledge or experience, and success was uncertain. Undoubtedly, a much greater acreage was actually planted than the 1926 figure of acceptable plantations would suggest.

Increasing interest in planting led in 1924 to the inclusion of provision for cooperative tree distribution in the Clarke-McNary Act. The first trees were distributed under this law in 1926, and organized reforestation efforts became widespread. Systematic planting records

for the Nation as a whole also had their beginning in 1926, as a result of the reporting system necessary to administer the Clarke-McNary Act.

Area of Acceptable Plantations Low Nationally

The total planting on commercial forest land in the United States had reached 6.9 million acres by 1952. Of this total 5.2 million acres were considered acceptable (table 1).[2] The acceptable plantations are composed largely of coniferous species. The hardwoods are more difficult to regenerate artificially and have not been planted to any great extent.

The close to 5 million acres of acceptable plantations established since 1926 appear at first glance rather an impressive accomplishment. However, 5 million acres in more than a quarter of a century is not outstanding progress. As will be shown later, in relation to the total area awaiting planting, it represents only a modest beginning.

North Leads in Area of Acceptable Plantations

The area of acceptable plantations is about equally divided between the North and the rest of the country (table 1). In percentage the North leads with 51 percent, the South is next with 38 percent, and the West last with 11 percent.

Among the regions, the Lake States is first with 27 percent of the national total, while the Southeastern region is close behind with 23 percent. Other leading regions are the Middle Atlantic with 15 percent, West Gulf with 10 percent, and Pacific Northwest with 7 percent.

Area of Acceptable Plantations about Equally Divided between Public and Private Ownerships

About 48 percent of acceptable plantations are on private lands; 52 percent are on public ownerships (table 2 and fig. 1). The percentage in public ownership is distributed 30 percent on Federal and 22 percent on State and other public holdings.

National forest plantations make up most of the Federal total, with 27 out of 30 percent. They comprise over one-fourth of all acceptable plantations in the United States. The States have 17 percent of the national total and the local units of Government 5 percent.

The ownership of acceptable plantations by sections is distributed fairly equally in the North between Federal, local public, and private, with local public holding a slight lead; in the South it is primarily private; and in the West predominantly Federal.

2/ Area of acceptable plantations and plantable area by States and ownership classes are given in the appendix tables.

Table 1.--Acceptable plantations on commercial forest land, by section and region, 1952 (Continental United States)

Section and region	Area of acceptable plantations	Proportion of total
	Thousand acres	Percent
North:		
New England	159	3.0
Middle Atlantic	780	15.0
Lake States	1,391	26.7
Central	283	5.4
Plains	56	1.1
Total	2,669	51.2
South:		
South Atlantic	300	5.8
Southeast	1,182	22.7
West Gulf	495	9.5
Total	1,977	38.0
West:		
Pacific Northwest	376	7.2
California	26	.5
Northern Rocky Mtn.	115	2.2
Southern Rocky Mtn.	47	.9
Total	564	10.8
Total, United States	5,210	100.0

Table 2.--Acceptable plantations on commercial forest land, by ownership class, 1952 (Continental United States)

Ownership class	Area of acceptable plantations	Proportion of total
	Thousand acres	Percent
Federal:		
National forest	1,419	27.2
Bureau of Land Management	14	.3
Indian	12	.2
Other Federal	141	2.7
Total	1,586	30.4
Other public:		
State	900	17.3
County and municipal	250	4.8
Total	1,150	22.1
Private 1/	2,474	47.5
All ownerships	5,210	100.0

1/ Due to the variety of sources contributing data and the differing methods of compilation used by them, no statistics can be presented for private land by size class or type of ownership.

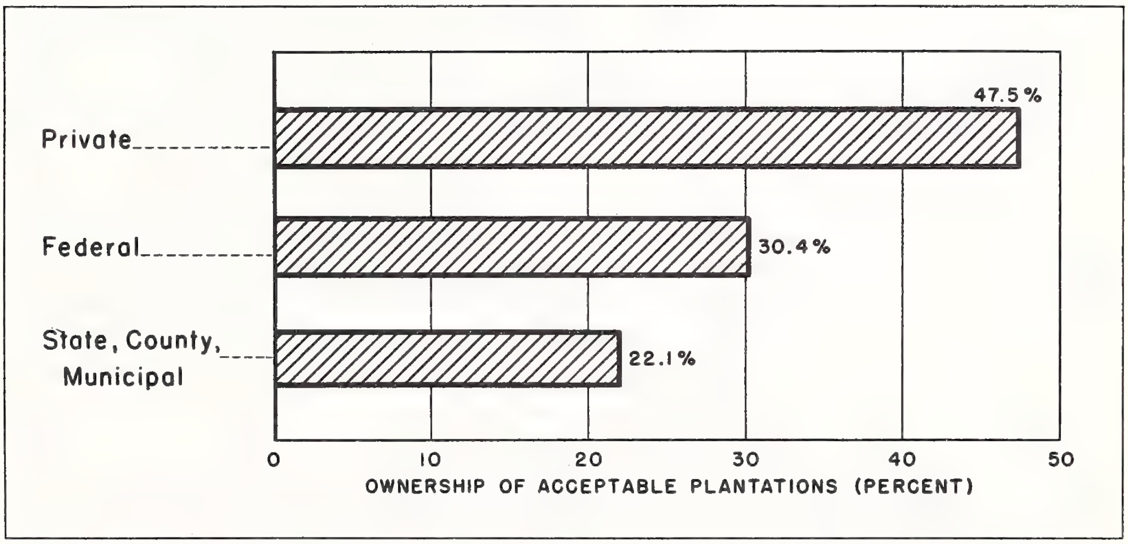

Fig.1 - Area of acceptable plantations in continental United States by ownership class, 1952.

Planting Success Highest in South

Early attempts at planting in the United States were beset with serious difficulties. Besides the natural hazards, little knowledge of artificial regeneration was available either from experience or research. Failures were frequent at the outset, but as planting continued better understanding and better techniques were developed. The success for all past planting in the Nation as a whole is 76 percent (table 3).

Sectionally, the South leads the North and West with a success of 85 percent, as against 71 percent and 75 percent, respectively. Among the chief reasons for the better showing of the southern section are (1) its later entrance on the planting scene, enabling it to profit from experience accumulated in the North, (2) favorable climate, (3) productive soils, and (4) superior planting species. The West has gained its near average success largely because of the 90-percent success for the Pacific Northwest, the most successful of the regions.

The Pacific Northwest, Southeast, South Atlantic, West Gulf, and Lake States Regions all exceed the national rating of 76 percent. California and the Southern Rocky Mountain Regions stand out as the chief problem areas with only 31 percent and 55 percent planting success, respectively. Natural obstacles to planting are very severe in these regions and will be difficult to overcome.

State and local governments appear to have had somewhat more planting success than either the Federal Government or private ownerships. However, the minor differences are probably more apparent than real, when variations in planting difficulty and site are taken into account.

Plantable Area, 1952

Plantable area, as defined earlier in this report, has accumulated from several sources. Among the more important ones are (1) fire alone, (2) logging followed by fire, and (3) the abandonment of agricultural land. Insects, disease, animals, poor cutting practices, overgrazing, hurricanes and other catastrophes of nature have also contributed extensive areas in need of reforesting. Although widespread and in varying condition, practically all such lands can be put back into production within a reasonable period only by planting.

Plantable Area Large, Nationally

There are 51.9 million acres of plantable commercial forest land in the United States (table 4). It constitutes about 11 percent of the total area of commercial forest lands. The significance of this large area of potentially productive timberland has already been pointed out. It will grow timber; it will lend itself to planting. Much of this area should be restored to a higher level of productivity with as little delay as possible.

Table 3.--Success of past planting on commercial forest land, by section and region, and by ownership class, 1952 (Continental United States)

Section and region	Proportion of total plantations acceptable							
	Federal			Other public			Private	All ownerships
	National forest	Other	Total	State	County and municipal	Total		
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
North:								
New England	67	1/ 100	75	69	67	68	57	62
Middle Atlantic	84	..	84	76	77	76	51	63
Lake States	73	74	73	88	86	88	78	79
Central	84	67	83	73	58	70	60	68
Plains	53	..	53	50	..	50	69	63
Total	74	72	74	80	80	80	60	71
South:								
South Atlantic	96	73	84	81	67	79	81	82
Southeast	95	82	90	87	1/ 100	88	86	87
West Gulf	76	65	75	83	1/ 100	91	84	81
Total	87	78	84	85	92	86	85	85
West:								
Pacific Northwest	91	87	90	90	83	90	90	90
California	35	..	35	..	..	..	24	31
Northern Rocky Mountain	70	1/ 100	70	1/ 100	..	1/ 100	..	70
Southern Rocky Mountain	55	56	55	..	..	..	50	55
Total	71	79	72	91	83	90	76	75
All regions	76	78	76	81	80	81	74	76

1/ Perfect planting score due to small areas of plantations rounded off to nearest 1,000 acres.

Table 4.--Plantable commercial forest land, by section and region, 1952 (Continental United States)

Section and region	Total commercial forest area	Plantable area: Acreage	Plantable area: Proportion of total	Proportion of commercial area plantable
	Thousand acres	Thousand acres	Percent	Percent
North:				
New England	30,658	1,228	2.4	4.0
Middle Atlantic	42,225	3,725	7.2	8.8
Lake States	53,272	7,651	14.7	14.4
Central	42,394	7,869	15.1	18.6
Plains	5,492	975	1.9	17.8
Total or average	174,041	21,448	41.3	12.3
South:				
South Atlantic	46,152	4,081	7.8	8.8
Southeast	94,985	14,214	27.4	15.0
West Gulf	52,151	3,652	7.0	7.0
Total or average	193,288	21,947	42.2	11.4
West:				
Pacific Northwest	45,365	2,468	4.8	5.4
California	17,317	4,104	7.9	23.7
Northern Rocky Mtn.	33,840	1,169	2.2	3.5
Southern Rocky Mtn.	20,489	812	1.6	4.0
Total or average	117,011	8,553	16.5	7.3
Total or average, United States	484,340	51,948	100.0	10.7

East Has Greatest Share of Plantable Area

Nearly 84 percent of the plantable commercial forest land is located in the eastern half of the United States. The acreage is quite evenly divided between North and South; 21.4 million acres in one case - 21.9 million acres in the other (table 4).

Among the regions, the Southeast stands out with more than one-fourth of the national plantable area. The Southeast, Central, and Lake States collectively contain 57 percent of all plantable area. Two other regions, California and South Atlantic, each have plantable area in excess of 4 million acres.

In ratio of plantable area to commercial forest area, California leads the regions with 24 percent (table 4). Other regions which are high in this regard are Central (19 percent), Plains (18 percent), Southeast (15 percent), and Lake States (14 percent).

The States with the largest plantable areas are California, Florida, Mississippi, Illinois, Michigan, Minnesota, and Wisconsin, each with 2 million acres or more (see appendix table). Their combined plantable area is about 24 million acres, or nearly half of the United States total.

Bulk of Plantable Area Is in Private Ownership

The most striking feature with regard to ownership of plantable area, nationally, is the heavy concentration (83 percent) in private ownership (table 5 and fig. 2). Only 17 percent is in public ownership. In the West, however, the 8.6 million acres of plantable area are about equally divided between private and public ownership.

The proportion of plantable area to total commercial forest area shows an interesting contrast (table 5). For State, county, and municipal ownerships combined, and for private holdings, the proportion is twice that on Federal lands. To state it in another way, the proportion of plantable area on Federal lands is much lower than on private and other public ownerships.

Natural Reduction in Plantable Area

There is another aspect of the reforestation situation which should not be overlooked. It appears that a gradual reduction in plantable area is now taking place through natural seeding. This marks a reversal of earlier trends, and can be attributed, primarily, to better fire protection and generally improved forest management practices.

Results of this planting study suggest that a net reduction in plantable area without planting of 0.6 percent per annum can be expected in the years ahead. Although in the right direction, the reduction is so slow that it fails to nullify the desirability of planting. At the rate indicated, it would take 165 years of natural restocking to eliminate plantable area. It seems obvious that restoration of these lands to productivity should be hastened by artificial means.

Table 5.--Plantable commercial forest land, by ownership class, 1952 (Continental United States)

Ownership class	Total commercial forest area	Plantable area: Acreage	Plantable area: Proportion of total	Proportion of commercial area plantable
	Thousand acres	Thousand acres	Percent	Percent
Federal:				
National forest	81,314	4,567	8.8	5.6
Bureau of Land Management	5,513	247	.5	4.5
Indian	6,945	210	.4	3.0
Other Federal	5,102	593	1.1	11.6
Total or average	98,874	5,617	10.8	5.7
Other public:				
State	19,169	2,276	4.4	11.9
County and municipal	8,047	1,009	1.9	12.5
Total or average	27,216	3,285	6.3	12.1
Private	358,250	43,046	82.9	12.0
All ownerships	484,340	51,948	100.0	10.7

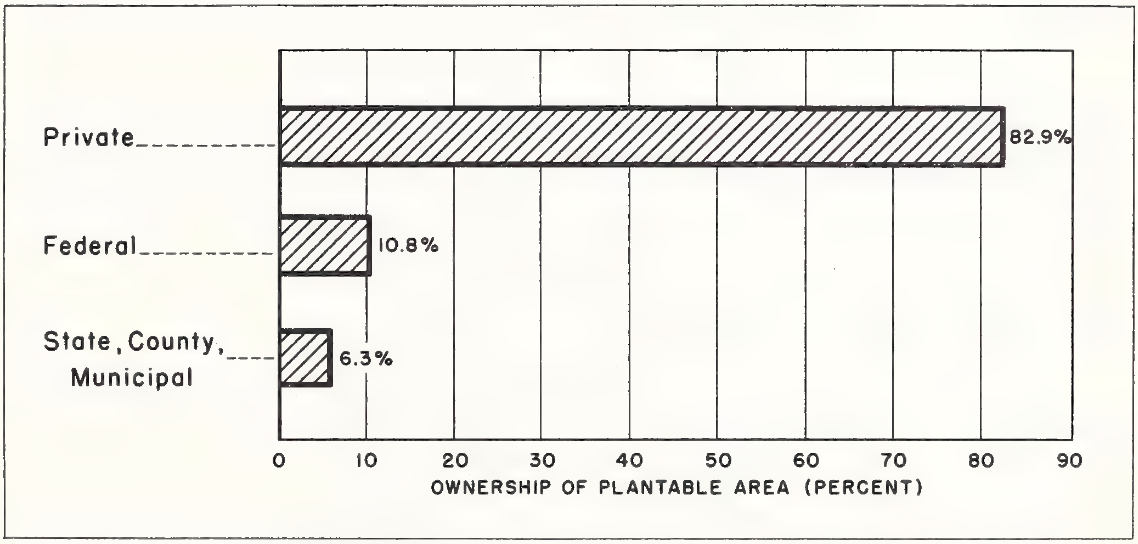

Fig. 2 - Area of plantable commercial forest land in continental United States by ownership class, 1952.

Where Do We Stand?

Two elements of the planting analysis have now been presented - acceptable plantations established by 1952 and plantable area. Putting the two items together, how does past planting progress compare with the total area awaiting planting?

Planting Progress Generally Low in Relation to Total Plantable Area

Nationally, only 9 percent of the total plantable area has now been planted (table 6). The picture is clear. Just a bare start has been made on planting in the United States.

Sectionally, the North has gone farthest both in area of acceptable plantations and in percent of total plantable area reforested (table 6). Even its proportion of 11 percent is very low and only slightly above the national average. The South follows with 8 percent, while the West is lowest with 6 percent.

By regions, the Middle Atlantic, Lake States, and Pacific Northwest have made the best records, with 17, 15, and 13 percent of total plantable area planted, respectively. The New England and West Gulf Regions also exceed the national average. California is outstandingly weak in the comparison, with the Central Region also noticeably low.

Public Forests Lead in Proportion of Total Plantable Area Planted

Private ownerships in the United States contain 80 percent of the total plantable area (table 7 and fig. 3). They have, however, planted only 5 percent of the almost 46 million acres involved.

By contrast, Federal ownerships contain 13 percent of the total plantable area, of which 22 percent has been planted. State, county, and municipal ownerships have done a bit better by planting 26 percent of their total plantable acreage.

These variations in progress by region and by ownership class do not obscure the really vital fact, that in comparison to the over-all planting job, the advance so far has been slow. Too many of the lands idle at the start of organized planting are still idle.

Comparison with Reappraisal Estimates

An earlier study of the forest situation in the United States was made by the Forest Service during 1945 and 1946. It was reported in the publication "Forests and National Prosperity", but is commonly referred to as the "Reappraisal".[3] The brief general treatment of the planting situation at that time contains few statistics. In only one case is

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3/ Forests and National Prosperity. A Reappraisal of the Forest Situation in the United States. U.S.D.A. Misc. Publication No. 668. August 1948.

Table 6.--Status of planting on commercial forest land, by section and region, 1952 (Continental United States)

Section and region	Total plantable area 1/	Area of acceptable plantations	Proportion of total plantable area planted, 1952
	Thousand acres	Thousand acres	Percent
North:			
New England	1,387	159	11.5
Middle Atlantic	4,505	780	17.3
Lake States	9,042	1,391	15.4
Central	8,152	283	3.5
Plains	1,031	56	5.4
Total or average	24,117	2,669	11.1
South:			
South Atlantic	4,381	300	6.8
Southeast	15,396	1,182	7.7
West Gulf	4,147	495	11.9
Total or average	23,924	1,977	8.3
West:			
Pacific Northwest	2,844	376	13.2
California	4,130	26	.6
Northern Rocky Mtn.	1,284	115	9.0
Southern Rocky Mtn.	859	47	5.5
Total or average	9,117	564	6.2
Total or average, United States	57,158	5,210	9.1

1/ Sum of plantable area in 1952 and area of acceptable plantations in 1952.

Table 7.--Status of planting on commercial forest land, by ownership class, 1952 (Continental United States)

Ownership class	Total plantable area		Area of acceptable plantations	Proportion of total plantable area planted, 1952
	Acreage	Proportion of total		
	Thousand acres	Percent	Thousand acres	Percent
Federal:				
National forest	5,986	10.5	1,419	23.7
Bureau of Land Management	261	.4	14	5.4
Indian	222	.4	12	5.4
Other Federal	734	1.3	141	19.2
Total or average	7,203	12.6	1,586	22.0
Other public:				
State	3,176	5.6	900	28.3
County and municipal	1,259	2.2	250	19.9
Total or average	4,435	7.8	1,150	25.9
Private	45,520	79.6	2,474	5.4
All ownerships	57,158	100.0	5,210	9.1

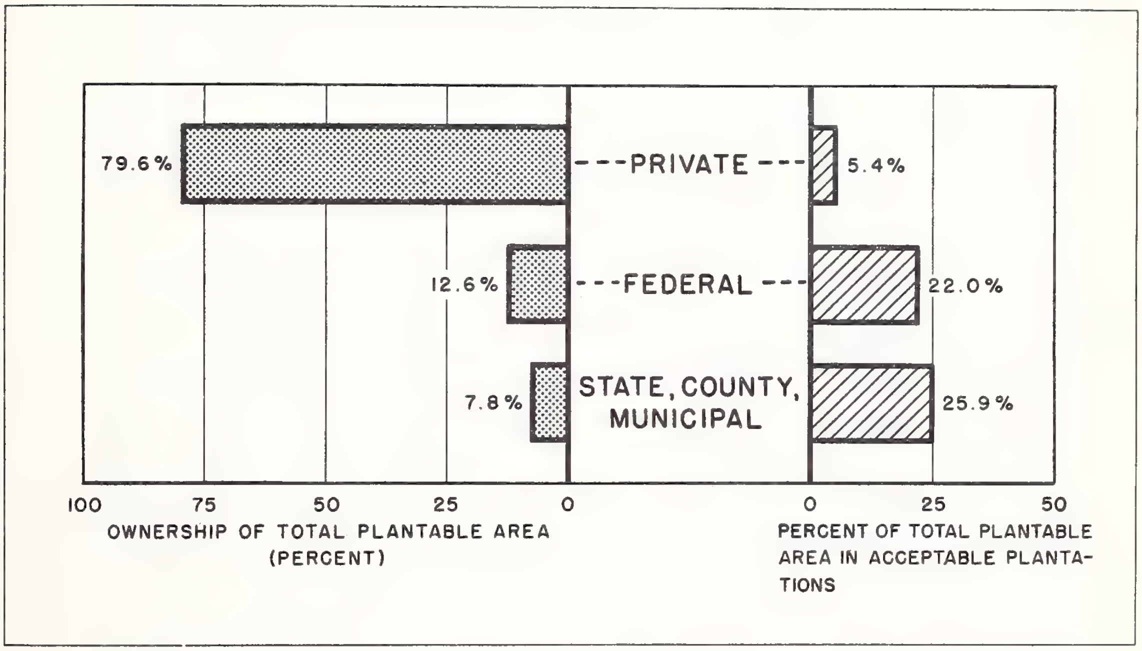

Fig. 3 - Status of planting on commercial forest land, by ownership class, in continental United States, 1952.

there an entirely comparable figure in the Timber Resource Review, as shown in the following tabulation:

Item	Reappraisal estimate, 1945 (million acres)	Timber Resource Review estimate, 1952 (million acres)
Poorly stocked or deforested commercial forest land	75.3	70.0
Forest area planted on commercial and noncommercial forest land	5.0	..
Forest land planted, commercial only	..	6.9
Area of acceptable plantations on commercial forest land	..	5.2
Net area needing planting, commercial forest land	67.0	..
Plantable area on commercial forest land	..	51.9
Expectation of possible future planting on commercial forest land	30.0 to 35.0	..
Area of acceptable plantations on commercial forest land anticipated by 1984	..	30.2
Area that would profit from interplanting	23.0	..

The estimate of poorly stocked or deforested commercial forest land decreased from 75.3 million acres at the time of the Reappraisal to 70.0 million acres in 1952. This reduction of 5.3 million acres is due to the establishment of acceptable plantings and natural restocking over the seven-year period.

Other figures are not comparable, although treating somewhat similar phases of the planting problem. For example, the 67.0 million acres estimated as needing planting in the Reappraisal includes lands which might not be physically practical to plant, while doubtful lands are excluded from the 51.9 acres of plantable area in the current review. Similarly, the other estimates in the two studies are not comparable without careful adjustment and interpretation.

Planting Trends

While the present status of planting, as judged by area planted in relation to total areas available for planting provides little cause for comfort, an examination of trends in artificial regeneration is

more encouraging. The trend toward natural reduction of plantable area has already been discussed. Planting trends and the combined effect of artificial regeneration and natural restocking still must be considered.

Rate of Planting Has Risen Sharply

Over the past 25 years the rate of planting in the United States has increased over five times (table 8 and fig. 4). The rise has not been steady, but rather has been marked by two rapid spurts. During the 1930's there was a sharp increase in planting under the stimulation of the emergency conservation program. Activity fell off during the war years, but has climbed rapidly again since the late 1940's. The rise in rate is due primarily to greatly increased planting in the South.

The cumulative total area of acceptable plantations shows the same general pattern (table 8 and fig. 5). Here, again, the more rapid accretion during the 1930's and post-war years is apparent. It has been emphasized that 5.2 million acres fall far short of total planting needs. The fact remains, however, that this acreage is almost 15 times the 352 thousand acres of acceptable plantations established prior to 1926.

Planting Rate Expected to Go Still Higher

In appraising the possible future rate of planting, a number of factors were apparent which suggested a rise in the immediate future. Chief among them were new machines for planting, increasing general interest especially by industrial groups and bankers, and better nursery stock. Opinions as to the combined effect of these factors were gathered from informed people at the State and regional levels. The estimates of future planting trends made in this way are summarized in table 9; they are speculative, of course, but represent the judgment of informed people. These estimated trends anticipate that the rate of planting will continue to increase for a couple of decades and then drop slightly. A maximum of over 800 thousand acres may be attained during the period 1965 to 1974.

By 1975 the more favorable planting sites and largest blocks of plantable area should be reforested. It is expected that increasing planting difficulties will reduce the rate of planting slightly thereafter.

Several likely developments may modify the anticipated trends. Standards for acceptable plantations may become higher. This has already happened during the past 25 years in some parts of the country. Planting rather than waiting for natural regeneration after harvest cutting may increase. Interplanting may be extended into areas more than 10 percent stocked. Catastrophes of man and nature could alter the projections considerably. Some of these developments seem likely and would expand future planting activity and sustain the estimated rate longer.

The acreage of plantable area remaining in 1952 looms large in comparison with the area of acceptable plantations established by that year. It is encouraging, however, to note that the area of acceptable plantations expected during the period 1953 to 1984 is also much

Table 8.--Area of acceptable plantations established on commercial forest land, by section and region, and by specified years up to and including 1952 (Continental United States)

Section and region	Plantations established--									
	Prior to 1926	1926-29	1930-34	1935-39	1940-44	1945-49	1950	1951	1952	Total
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
North:										
New England	40	31	28	28	14	7	3	4	4	159
Middle Atlantic	71	84	158	167	94	87	35	39	45	780
Lake States	117	75	202	480	247	137	34	52	47	1,391
Central	35	5	5	54	53	58	17	26	30	283
Plains	23	8	7	8	4	3	1	1	1	56
Total	286	203	400	737	412	292	90	122	127	2,669
South:										
South Atlantic	1	2	8	67	63	59	40	30	30	300
Southeast	1	4	17	258	305	222	143	107	125	1,182
West Gulf	1	33	15	121	67	68	62	70	58	495
Total	3	39	40	446	435	349	245	207	213	1,977
West:										
Pacific Northwest	24	16	23	42	54	75	46	43	53	376
California	1	4	5	4	4	1	1	2	4	26
Northern Rocky Mountain	27	7	31	24	12	8	2	2	2	115
Southern Rocky Mountain	11	5	7	10	5	5	2	1	1	47
Total	63	32	66	80	75	89	51	48	60	564
Total, United States	352	274	506	1,263	922	730	386	377	400	5,210
Annual rate	(1/)	2/ 68	101	253	184	146	..	3/ 388	..	..
Cumulative total	352	626	1,132	2,395	3,317	4,047	4,433	4,810	5,210	5,210

1/ Undertermined number of years.
2/ Four-year average.
3/ Three-year average.

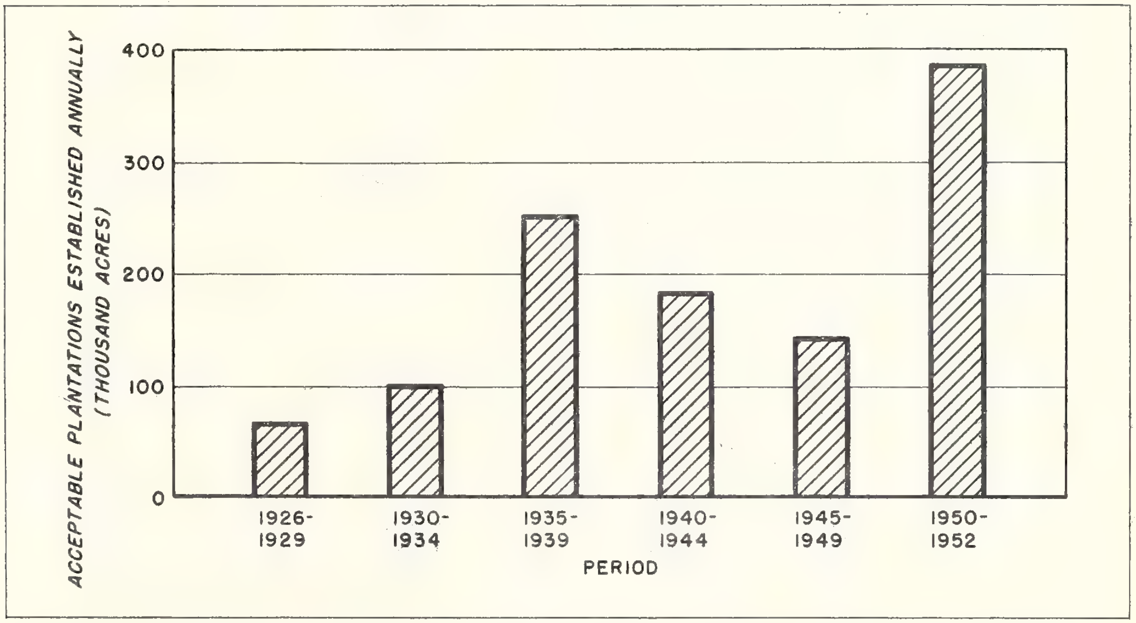

Fig. 4 - Average annual rate of planting on commercial forest land in continental United States by specified periods, 1926-52.

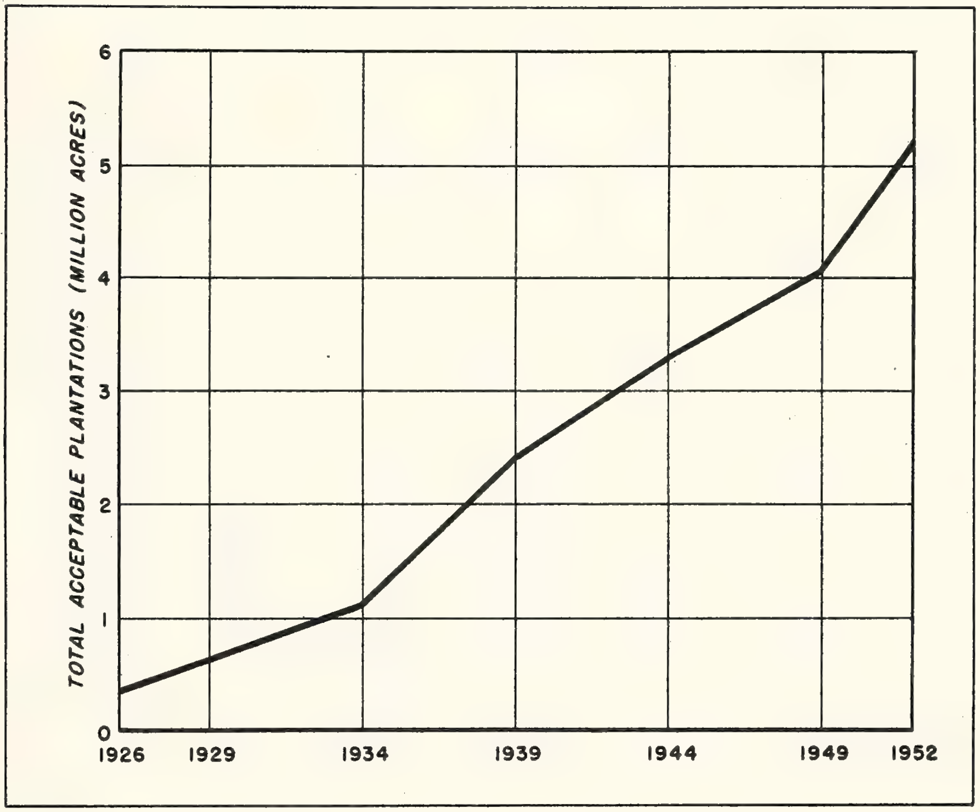

Fig. 5 - Cumulative total area of acceptable plantations on commercial forest land in continental United States 1926-52.

Table 9.--Anticipated area of acceptable plantations on commercial forest land, by section, and by specified years up to and including 1984 (Continental United States)

Section	Plantations established prior to 1953	Anticipated future plantings				
		1953-54	1955-64	1965-74	1975-84	Total
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
North	2,670	320	1,850	1,840	1,820	8,500
South	1,980	760	5,140	5,170	4,820	17,870
West	560	130	880	1,090	1,120	3,780
Total, United States	5,210	1,210	7,870	8,100	7,760	30,150
Annual rate	(1/)	610	790	810	780	..
Cumulative total	5,210	6,420	14,290	22,390	30,150	30,150
Cumulative total from 1953	..	1,210	9,080	17,180	24,940	..

1/ Undetermined number of years.

greater than the area successfully planted by 1952 (fig. 6). We can at least expect considerably better planting progress in the future than in the past. If present indications hold, the area of acceptable plantations may reach 30 million acres by 1984.

A Long Way to Go

Two existing trends which act to reduce the large plantable area in this country have been discussed. One is the natural reduction which tends to build up as forest lands receive better protection. Eventually, over a very long period, natural restocking alone would restore much of the plantable area to some measure of productivity. Obviously, it would be impractical to do nothing but let nature take its course. The second trend which serves to reduce plantable area is the increasing total of acceptable plantations.

By way of summary at this point, it is interesting to speculate where the combined action of these two trends might leave the planting situation in 1984 (fig. 7). Although the reduction in this case would be very great, a plantable area of more than 11 million acres would still remain. Also, they would be the areas most difficult to reforest. Furthermore, this assumes that no catastrophes of nature or man will upset the anticipated pattern.

The future trends presented here are speculative, although based on developments in the past and an understanding of the present situation. However, if present trends continue as outlined here, and if no unforeseen difficulties arise, the remaining plantable area can be low by the turn of the century. Developments such as faster growing species with pest resistance through genetics and learning how to plant the more difficult sites would help immeasurably.

On the other hand there are factors outside the scope of this study which might maintain planting on a higher level and for a longer time than the trends of planting and reduction of plantable area suggest. As already mentioned, planting in lieu of natural regeneration, higher standards of artificial reforestation generally, and interplanting in stands more than 10 percent stocked are the more notable ones. Together they represent a potentially large phase of planting not considered here.

Despite the rather strong indications that in future years the planting picture will brighten considerably, one feature overshadows all other aspects of the situation. That is the established fact that in 1952 we still have a long way to go. Only 5.2 million acres are in acceptable plantations; 51.9 million acres await planting (fig. 8). Although varying somewhat in degree, the condition is essentially the same in all sections of the country and in all ownerships.

PLANTING NONCOMMERCIAL FOREST LAND AND SHELTERBELTS

In addition to plantations on commercial forest land which will eventually be harvested for forest products, there are other desirable plantings. They are primarily valuable for some other purpose than

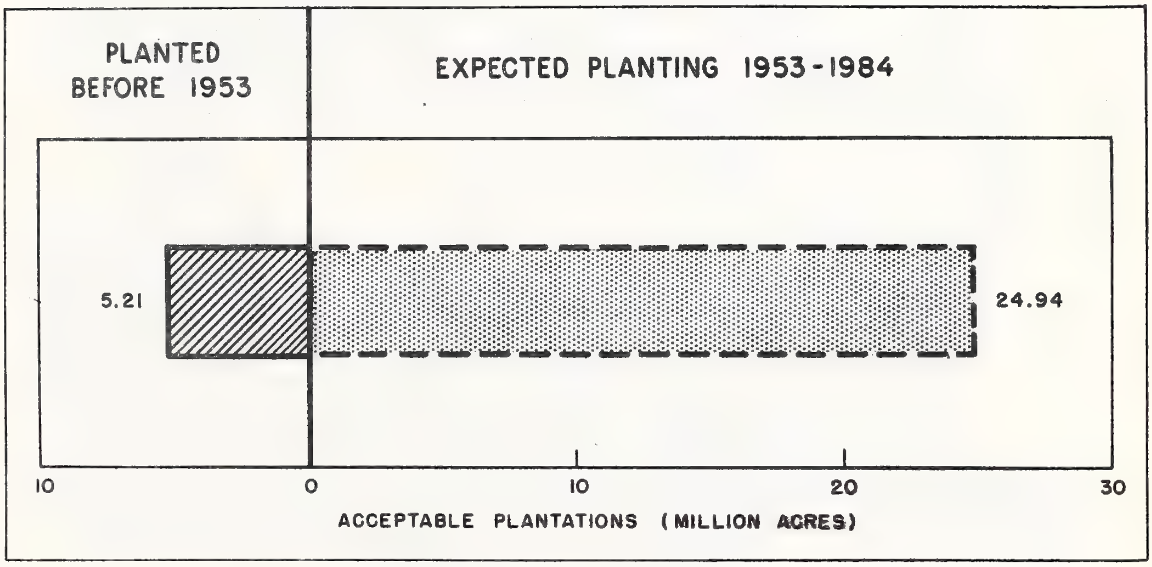

Fig. 6 — Planting before 1953 compared to anticipated planting, continental United States, 1953-1984

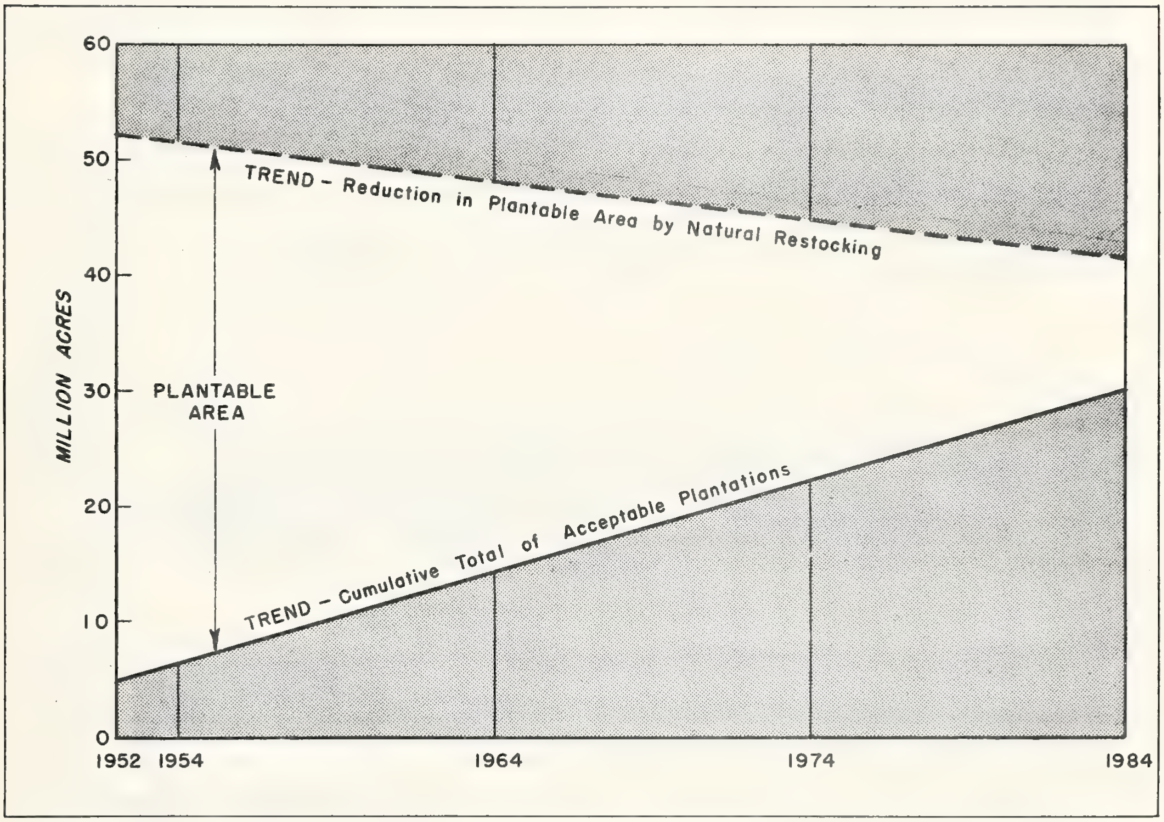

Fig. 7 - Possible future reduction of plantable area by natural restocking and artificial regeneration, continental United States 1/

1/ Does not include artificial regeneration in lieu of natural restocking, planting to meet the higher standards likely in the future, or interplanting on lands more than 10 percent stocked. The combined effect of these factors could keep the trend lines apart for much longer than the figure suggests.

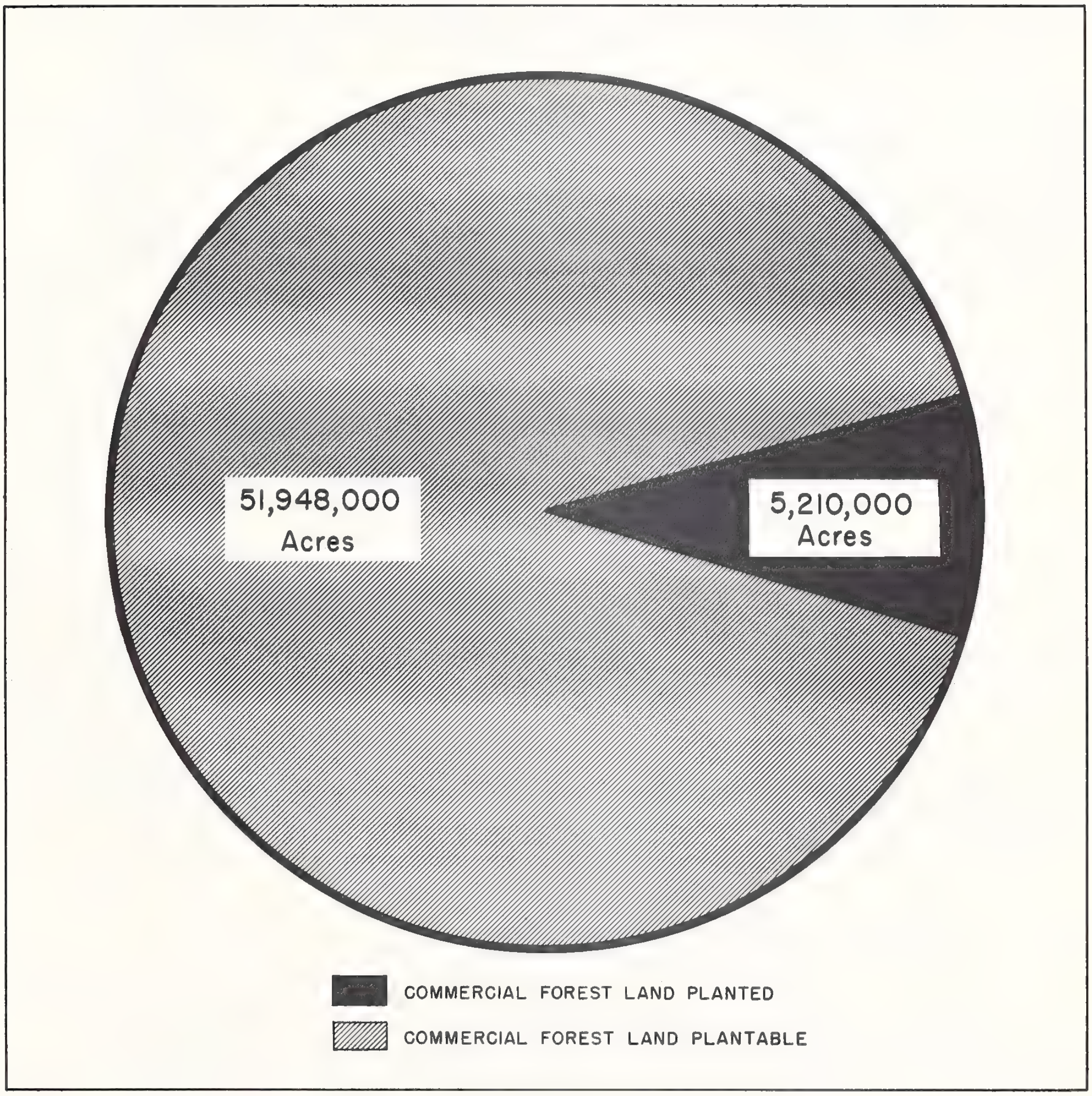

Fig. 8 – Status of planting on commercial forest land in continental United States, 1952

timber yields, and would not serve their highest utility if disturbed by harvest cutting. Plantings for flood control and watershed protection, wildlife habitat, and aesthetic purposes will fall into this category if timber harvesting is incompatible with their primary use. If harvestable without conflict with their principal function, they are included with commercial forest areas. Most forest plantations can be subjected to such multiple use. Other plantings may be made on reserved productive areas such as parks and restricted military reservations and in situations where land use policies make harvest cutting unlikely.

The practice of planting trees as shelterbelts to protect buildings and crops has been employed in the United States for years. Early settlers in the prairie states did considerable of this type of planting. The most noteworthy effort in this line was the Prairie States Forestry Project, commonly called the Shelterbelt Project, during the 1930's. Nearly 223 million trees were planted on private land in the Plains Region under this program.

Both planting on noncommercial forest land and shelterbelts require nursery stock and establishment effort. They are an inseparable part of the reforestation picture, and so are included in this analysis.

Acceptable Plantations on Noncommercial Forest Land Established by 1952

Acceptable plantations on noncommercial forest land in the United States total 96 thousand acres in 1952 (table 10). Of this total 92 percent is in the North, with the balance (8 percent) in the West. State and private ownerships together have 74 percent of the acceptable plantations, while the States alone have 44 percent.

Planting success has been spotty, with survival varying all the way from 90 percent reported from New York to 10 percent for California. The national score is 96 thousand acres of acceptable plantations out of 168 thousand acres planted, or a success of 57 percent.

Plantable Area Remaining on Noncommercial Forest Land

The total area of plantable noncommercial forest land in the United States is estimated at 5.4 million acres (table 11). The West has 72 percent of the plantable area, with the rest all in the North. Nearly one-half of the plantable noncommercial forest land is in private ownership; about one-fourth is national forest land; and the rest is in other Federal, State, and local ownerships.

About 20 percent of the plantable noncommercial area should be devoted to watershed protection and improvement. The bulk of the remainder needs wildlife habitat improvement.

Shelterbelt Planting

Shelterbelts established and still in existence by 1952 total 589 thousand acres, and are largely concentrated in the Plains Region of

Table 10.--Acceptable plantations on noncommercial forest land,[1] by section, and by ownership class, 1952 (Continental United States)

Ownership class	Acceptable plantations			
	North	South	West	Total United States
	Thousand acres	Thousand acres	Thousand acres	Thousand acres
Federal:				
National forest	..	..	..	..
Bureau of Land Management	..	..	2/0.3	0.3
Indian	..	..	2/ .3	.3
Other Federal	15	..	2/ .1	15
Total	15	..	1	16
Other public:				
State	42	..	..	42
County and municipal	9	..	..	9
Total	51	..	..	51
Private	22	..	7	29
All ownerships	88	..	8	96

1/ Shelterbelts not included.
2/ Although these acreages are small individually, they round off in total to 1,000 acres.

Table 11.--Plantable noncommercial forest land, by section, and by ownership class, 1952 1/ (Continental United States)

Ownership class	Plantable area			
	North	South	West	Total United States
	Thousand acres	Thousand acres	Thousand acres	Thousand acres
Federal:				
National forest	55	..	1,333	1,388
Bureau of Land Management	1	..	1,020	1,021
Indian	..	..	50	50
Other Federal	2	..	29	31
Total	58	..	2,432	2,490
Other public:				
State	169	..	107	276
County and municipal	186	..	2	188
Total	355	..	109	464
Private	1,093	..	1,400	2,493
All ownerships	1,506	..	3,941	5,447

1/ Excludes shelterbelts.

the North. Public ownership is rare with virtually all such plantings on private land.

Additional shelterbelts are desirable, and there will very likely be more of this planting in the future. They may ultimately approach 3 million acres. Almost all of this increase will be on private lands.

NURSERY FACILITIES

There is a possibility that direct seeding will be used more extensively and more successfully in reforestation efforts in the future. Be that as it may, the most likely prospect for years to come is that the bulk of artificial regeneration will be done with planting stock. What then will be the future requirements for planting stock and can they be met with existing facilities?

It is anticipated that acceptable plantations on commercial forest land to be established from 1953 to 1984, inclusive, will total 24.9 million acres (table 9). This will call for planting at the rate of approximately 780 thousand acres of acceptable plantations a year. By sections it breaks down to: North, 182 thousand acres; South, 497 thousand acres; and West, 101 thousand acres. On the basis of past planting success, the acreages of actual planting each year would be: North, 256 thousand acres; South, 585 thousand acres; and West, 135 thousand acres, a total of about 980 thousand acres.

With reasonable success in the establishment and survival of plantations on commercial forest land, the expected planting of the nearly 980 thousand acres a year would require the amounts of stock tabulated below:

Section	Million trees
North	220.2
South	578.0
West	89.4
Total, United States	887.6

An estimate of 888 million trees annually for the 32-year period ending in 1984 is on the conservative side. It does not provide for planting on noncommercial forest land, for shelterbelt planting, or the possibilities of increased planting effort to meet higher standards in the future, planting in lieu of natural regeneration, and of interplanting on areas stocked better than 10 percent. Taking these other elements of the tree planting load into account, a reasonable estimate of annual nursery stock requirements might be in the neighborhood of 1 billion trees.

In 1952 there were 170 forest and shelterbelt stock nurseries, public and private, operating in the United States. Their combined production was 462 million trees. To meet the average annual demand for planting stock envisaged in this report for the thirty-two years ending in 1984 would require more than double the 1952 production.

It is known that some nurseries are now operating below potential capacity. With them, a step-up in production is a matter of more money, more personnel, and more good seed. With new nurseries the location and acquisition of suitable areas are added to the other costs. An accurate measure of the nursery potential nationally is not available and an estimate is difficult to make. All that can be said with certainty is that substantially expanded nursery facilities will be needed to meet the level of planting expected.

SIGNIFICANCE OF THE PLANTING PICTURE

The major elements of the planting picture as of 1952 have now been summarized. The relatively small acreage successfully planted has been compared with the large area awaiting planting. Nearly 70 million acres, or 14 percent of the commercial forest area, are poorly stocked or deforested. About 52 million acres are plantable. Acceptable plantations cover only 5 million acres. The task of reclaiming idle forest land by artificial regeneration has merely started.

A more cheerful note is introduced into the appraisal by the rise in rate of planting over the past 25 years, and the expectation is that it will rise still further to a level of about 800 thousand acres of acceptable plantations a year, or twice the rate of 1952. Further encouragement is lent by the downward trend of plantable area due to natural restocking which is now becoming apparent. If expected trends hold, if anticipated advances in planting knowledge and species improvement materialize, and if natural or man-caused catastrophes fail to upset progress, the area of idle lands in need of artificial regeneration will be low by the turn of the century. Five factors which may prolong the planting effort for a much longer period are the extensive plantable area on noncommercial forest land, a heightened interest in shelterbelts, planting in lieu of natural regeneration, higher standards of artificial reforestation, and interplanting in stands more than 10 percent stocked.

The full significance of the potential benefits from restoring idle lands to production by artificial restocking cannot be appraised fully without looking ahead many years. Maximum values from current planting will not be realized until after the year 2,000. By that time trees measured now in terms of numbers of planting stock will be measured in board feet of lumber or cords of pulpwood. To give some meaning to the potential worth involved, it is noteworthy that if the present plantable area of 52 million acres were producing at a rate commensurate with even the lower growth goal considered in the Timber Resource Review, it would add about 8 billion board feet a year to the national timber harvest.

There is a tremendous challenge in the opportunity to build up timber production by recapturing presently nonproducing or low-producing forest lands. The major tool at our disposal is artificial regeneration by planting. So far we have taken much less than full advantage of it. The prospects are that we will do better in the future, but even after 30 years of greatly increased effort a sizeable acreage of plantable area will remain unproductive.

Regions and Sections used in the Timber Resource Review

TIMBER RESOURCE REVIEW

CHAPTER IV
FACTORS AFFECTING FUTURE SUPPLY AND QUALITY OF DOMESTIC TIMBER

D. OWNERSHIP OF FOREST LAND AND TIMBER

(Preliminary Review Draft Subject To Revision)

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INDEX TO TIMBER RESOURCE REVIEW REPORTS AND APPENDIX MATERIAL

(Each Chapter and each Section, in the case of Chapters IV and IX, is a separate document)

CHAPTER IV. F A C T O R S A F F E C T I N G F U T U R E S U P P L Y A N D Q U A L I T Y O F D O M E S T I C T I M B E R

D. OWNERSHIP OF FOREST LAND AND TIMBER

(Preliminary review draft subject to revision)

By:

H. R. Josephson
John R. McGuire

September, 1955

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OWNERSHIP OF FOREST LAND AND TIMBER

INTRODUCTION

The condition of forest lands and prospective timber growth depend to a major degree upon the decisions of several million individuals, corporations, and public owners of forest lands. This pattern of ownership represents one of the key factors affecting the Nation's timber supply. As primary dependence is placed upon the growing of new timber crops, the attitudes of forest owners, their capacity for management, and their response to forestry programs become of increasing importance in developing forest policies and action programs.

Field surveys show that forest productivity, planting, fire protection, and other management practices are all directly related to the character of owners and size of forest holdings. They are related to owners' financial capacity and interests in timber growing. Programs for American forestry, if they are to be successful, must recognize the key characteristics which influence the actions of a great variety of owners, particularly the vast number of private owners who control the bulk of the Nation's forest land.

THE INFLUENCE OF PUBLIC LAND POLICIES

Current problems of forest ownership to a large degree have their roots in historical ownership patterns and land policies followed at various stages of the Nation's history.

Origin of the Public Domain

In the original 13 States and Texas, a land area of about 460 million acres was held in private and State grants. But with the subsequent growth of the United States, the Federal Government acquired title to unoccupied or public domain lands totaling 1,442 million acres in the continental United States alone. This vast area was obtained from the original 13 States during the period 1781-1802, from France in 1803, from Spain in 1819, from Mexico in 1848 and 1853, from Texas in 1850, by occupation of the Oregon territory, and from Indian tribes through various treaties and purchases. Acquisition of Alaska from Russia in 1867 added an additional 365 million acres of land to the Federal public domain. A portion of the public domain in the United States was transferred to individuals or States to satisfy prior claims, but most of it was made subject to disposal under a wide variety of public land laws.

Lands Transferred to Private and State Ownership

The historical policy of the United States with respect to the public domain provided that the Federal Government act as trustee, with lands to be transferred to private ownership as rapidly as practicable. This policy was designed to aid in the development of agriculture, transportation, communications, and economic growth in the new western territories, and to strengthen the national economy.

In carrying out this policy, the Federal Government has disposed of more than 1 billion acres, or 70 percent of the public domain in the United States. This has been achieved primarily through public and private land sales; homestead grants and sales; grants to States for schools, internal improvements, and various institutions; grants to railroad corporations; grants to veterans; mineral entries; and sales under the Timber and Stone, Timber Culture, and desert land laws.

In this process of disposal, the Federal Government largely succeeded in fostering the settlement and rapid development of a vast wilderness. At the same time, large areas of timber, and other land in the West, were disposed of in tracts that were too small for efficient management. Much forest land was transferred to speculators and other owners through loose public land laws. In general, the most productive and accessible timber lands were disposed of to a variety of individual, corporate, and State ownerships.

Public Domain Reserved for National Values

From time to time, the Federal Government provided for retention of public domain lands in Federal ownership to meet certain paramount national needs. In the first major conservation action in 1891, Congress provided for the establishment of forest reserves, later to be known as national forests, to protect the timber and water resources on important portions of the remaining public domain. At various times, other withdrawals were made for national purposes, including Indian reservations, military reserves, national parks, reclamation and flood-control areas, and wildlife refuges.

About 230 million acres of land in the continental United States, or 16 percent of the original public domain, has thus been retained by the Federal Government for specific public uses. This includes 134 million acres in the national forests, 54 million acres held in trust for Indians, and 41 million acres in holdings administered by various other Federal agencies. In Alaska, about 21 million acres of public domain has been designated for national forests, 32 million acres for military reserves, and 19 million acres for other public uses.

Nearly a third of these 230 million acres of public-domain lands which have been retained for public uses in the continental United States is classed as commercial forest land. Somewhat more than a quarter of the total is noncommercial forest with high public values for such purposes as water, recreation, hunting and fishing. The balance is principally range, alpine, or desert lands.

Large Areas of Vacant Public Domain Remain

There also remains in the continental United States about 171 million acres of vacant, unappropriated, and unreserved public domain under the administration of the Bureau of Land Management. About 162 million acres are in Taylor Grazing Districts or are leased for grazing. These remnant, vacant, public-domain lands make up about 12 percent of the original public domain that has neither been specifically reserved for national purposes nor disposed of under the various land-disposal laws.

With the exception of scattered forest and woodland areas, these lands consist mainly of desert, semidesert, and rough mountainous land that have remained in Federal ownership largely because of their limited commercial value for private ownership. Most of Alaska--about 290 million acres--also is still vacant and unappropriated public domain.

Some Land Reacquired by Federal Government

Long-term trends in Federal holdings show a continuing net movement of land out of Federal ownership, although in certain periods, such as the depression years of the 1930's and World War II, acquisitions by the Federal Government have exceeded disposals of Federal land. From time to time, some land has been purchased or otherwise acquired for national forests, national parks, game refuges, reclamation, flood control, development of power and atomic energy, and other public purposes. During the years of the great depression of the 1930's, certain areas of submarginal farm land also were purchased by the Federal Government as part of a program of land conservation and utilization.

At the end of 1953, acquired lands totaled about 58 million acres, including 46 million acres obtained by purchase and 12 million acres acquired largely by exchanges and donations. These acquired lands represent about 13 percent of the 459 million acres of land owned or administered by the Federal Government in the continental United States.

Federal disposals of public domain and acquisitions of land over the years may be summarized as follows:

	Continental United States (million acres)	Alaska (million acres)
Original public domain	1,442	365
Disposals	1,041	3
Reserved for public purposes	230	72
Vacant and unappropriated	171	290
Purchases and other acquisitions	58	..
Total owned or administered by the Federal Government	459	362

State and Local Public Land Policies Vary

The area of public domain granted or reserved to the States by the Federal Government in the past totaled about 232 million acres. Most of these lands were subsequently transferred to private ownership. In 1950, State land holdings included only about 52 million acres of grants from the public domain, plus about 28 million acres acquired largely through tax delinquency. Much of the present State land is in scattered holdings suitable chiefly for range use, but roughly a fourth of the total is classed as commercial forest land. County and other local governments also have acquired fairly large areas of rural land, chiefly through tax delinquency, including about 8 million acres

of commercial forest land. Many of the State and local public land holdings are managed for such purposes as forests, parks, and game refuges or management areas, or are leased for grazing purposes. Some areas are without specific designated uses or development policies and some lands are available for sale.

THE PRESENT PATTERN OF COMMERCIAL FOREST LAND OWNERSHIP[1/]

Nearly Three-fourths of Forest Land is Privately Owned

As a result of past land policies which have favored small-scale, fee-simple ownership, about 358 million acres, or 73 percent of the Nation's commercial forest land, is in private holdings. Farm holdings represent the largest class of ownership, with 34 percent of the commercial forest land (table 1 and fig. 1). A variety of miscellaneous nonindustrial private owners hold 26 percent of the total area, and forest industries own 13 percent. Private owners also hold nearly a third of the non-commercial forest lands in the United States and Coastal Alaska.

Public holdings comprise only 27 percent of all commercial forests. About 17 percent of the total area is in national forests, 4 percent is in other Federal holdings, and 6 percent is in State and local public ownerships.

In the eastern regions, where practically all lands at one time passed into private ownership, most of the commercial forest land is still in private holdings. In the South, 91 percent of the commercial forest area is privately owned and, in the North, 81 percent (table 1 and fig. 1). On the other hand, in the West and Coastal Alaska most of the commercial forest land is still federally owned or administered; only 34 percent of the western commercial forests are in private holdings.

Private Lands Chiefly in Small Holdings

The private commercial forest lands in the Nation are widely dispersed in an estimated 4,510,500 separate ownerships (table 2). Although individual holdings vary widely in size from 3 acres to more than 2 million acres, the average private forest ownership contains only 79 acres.

"Small" holdings of less than 5,000 acres are of particular importance. More than half of the total commercial forest land in the country--or 265 million acres--is in these "small" private holdings (table 2 and fig. 2). A quarter of the total commercial forest area is in private holdings of less than 100 acres.

1/ Statistical data in this chapter pertain chiefly to sections or the Nation as a whole. More detailed statistics by States and regions are presented in the appendix.

Table 1.--Ownership of commercial forest land, by section, 1953
(United States and Coastal Alaska)

Type of ownership	All sections: Area	All sections: Proportion	North	South	West	Coastal Alaska
	Thousand acres	Percent	Thousand acres	Thousand acres	Thousand acres	Thousand acres
Private:						
Forest industries:						
Lumber manufacturer	34,687	7.1	3,955	18,517	12,215	..
Pulp manufacturer	23,276	4.8	9,224	12,188	1,864	..
Other wood manufacturer	4,419	.9	924	2,818	677	..
Total	62,382	12.8	14,103	33,523	14,756	..
Farm	165,217	33.8	61,394	90,143	13,680	..
Other private	130,670	26.7	66,118	52,943	11,590	19
Total all private	358,269	73.3	141,615	176,609	40,026	19
Public:						
National forest	84,759	17.4	10,282	10,372	60,660	3,445
Indian[1]	6,965	1.4	1,488	117	5,340	20
Bur. Land Managem't.[1]	6,298	1.3	72	154	5,287	785
Other Federal	5,102	1.0	1,252	3,553	297	..
Total Federal	103,124	21.1	13,094	14,196	71,584	4,250
State	19,169	3.9	12,546	1,857	4,766	..
County	7,048	1.5	) 6,786	) 626	) 635	..
Municipal and local	999	.2	)	)	)	..
Total all public	130,340	26.7	32,426	16,679	76,985	4,250
All ownerships	488,609	100.0	174,041	193,288	117,011	4,269

1/ Because of different definitions of commercial forest land, figures for these ownerships may vary from published figures of the public agencies concerned.

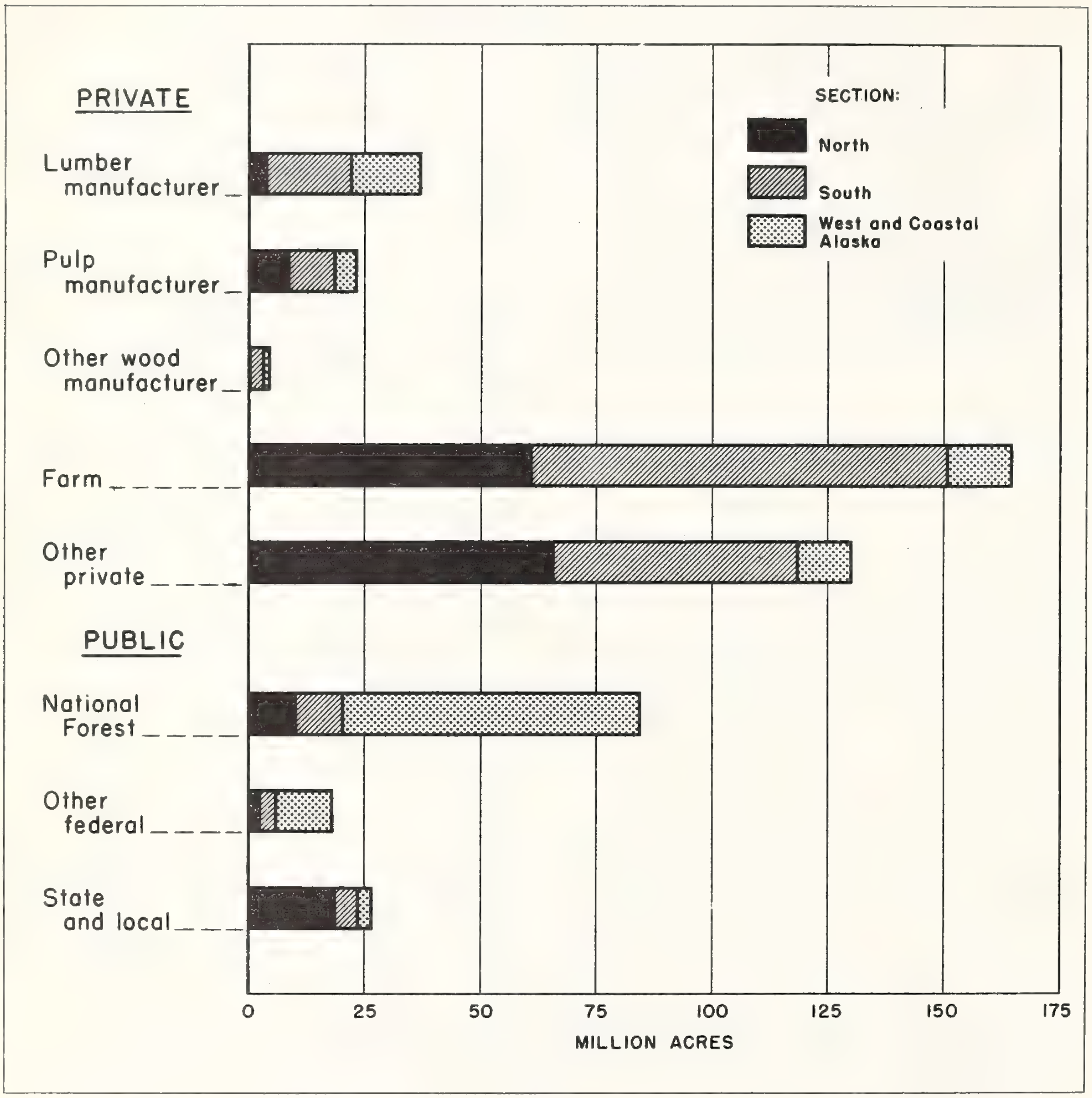

Fig. 1 - Ownership of commercial forest land by type of ownership and section, 1953.

Table 2.--Number of private ownerships of commercial forest land and area owned by size of holding and by section, 1953[1]
(United States and Coastal Alaska)

Size of ownership	Ownerships	Area	Proportion of commercial forest area	Average size of holding
Acres	Number	Thousand acres	Percent	Acres
ALL SECTIONS				
Less than 100[1]	3,875,093	121,023	24.8	31
100 - 500	586,467	97,882	20.0	167
500 - 5,000	46,326	46,378	9.5	1,001
Total	4,507,886	265,283	54.3	59
5,000 - 50,000[2]	2,330	34,669	7.1	14,879
Over 50,000[2]	283	58,317	11.9	206,067
Total	4,510,499	358,269	73.3	79
NORTH				
Less than 100[1]	2,316,089	69,338	14.2	30
100 - 500	224,935	37,608	7.7	167
500 - 5,000	12,259	10,214	2.1	833
Total	2,553,283	117,160	24.0	46
5,000 - 50,000[2]	563	8,279	1.8	705
Over 50,000[2]	75	16,176	3.2	215,680
Total	2,553,921	141,615	29.0	55
SOUTH				
Less than 100[1]	1,476,478	48,315	9.9	33
100 - 500	322,414	52,449	10.7	163
500 - 5,000	26,605	27,428	5.6	1,031
Total	1,825,497	128,192	26.2	70
5,000 - 50,000[2]	1,367	20,140	4.2	14,733
Over 50,000[2]	156	28,277	5.7	181,263
Total	1,827,020	176,609	36.1	97
WEST AND COASTAL ALASKA				
Less than 100[1]	82,526	3,370	0.7	41
100 - 500	39,118	7,825	1.6	200
500 - 5,000	7,462	8,736	1.8	1,171
Total	[3]129,106	19,931	4.1	154
5,000 - 50,000[2]	409	6,400	1.4	15,648
Over 50,000[2]	62	13,714	2.7	221,194
Total	129,577	40,045	8.2	310

1/ Number of ownerships shown for holdings of 3 - 100 acres in the East and 10 - 100 acres in the West.

2/ Numbers of ownerships in a given size class on a sectional basis do not add to national totals because holdings of a given owner located in different regions have been combined in determining number of ownerships on a national basis.

3/ Includes 286 ownerships in Coastal Alaska.

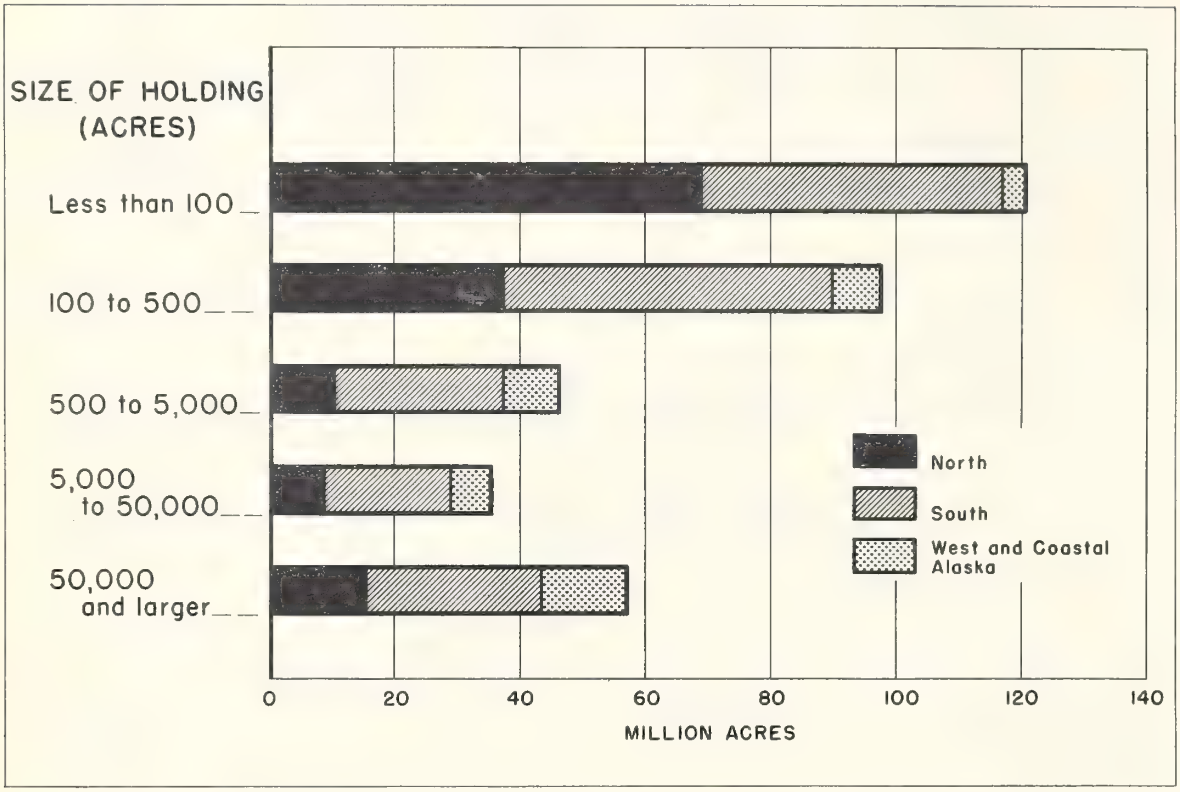

Fig. 2 - Area of commercial forest land in private ownership by size of holding and section, 1953.

"Medium" ownerships of 5,000 to 50,000 acres account for about 7 percent of the total commercial forest area. There are about 2,330 of these holdings, with a total area of 35 million acres.

"Large" private holdings of more than 50,000 acres number 283. They represent a total area of 58 million acres, or 10 percent of all commercial forests. Seven of these large ownerships average 2,103,000 acres, and together amount to roughly 3 percent of the Nation's commercial forest land, as shown in the following tabulations:

Size class (acres)	Ownerships (number)	Area (million acres)	Average area per ownership (acres)
50,000 - 250,000	233	24.3	104,000
250,000 - 500,000	30	10.7	358,000
500,000 - 1,000,000	13	8.6	658,000
1,000,000 plus	7	14.7	2,103,000
All classes	283	58.3	206,000

Since some owners hold land in more than one State, when duplications of ownerships are eliminated there are fewer medium and large ownerships on a regional or national basis than when size of ownerships is determined by area owned within a State, as shown in table 3.

On a geographical basis, small holdings include most of the private commercial forest land in the northern and southern sections of the country. In the West, on the other hand, only about half the total area in private ownership is in holdings of less than 5,000 acres (table 2 and fig. 2). In terms of numbers as well as area, private ownerships are concentrated in the East, with 57 percent of all private ownerships found in the North and 40 percent in the South. Only 3 percent of the private ownerships are located in the West and Coastal Alaska. In the western regions, private ownerships include an average of 310 acres of forest land, compared with 97 acres in the South and only 55 acres in the North.

Comparisons of 1953 estimates with data from the 1945 Reappraisal show an increase of roughly 185,000 small owners (i.e., holding less than 5,000 acres), although exact figures cannot be determined because of changes in the basis of classification. There is some evidence of both subdivision of small holdings since 1945 and some consolidation of medium and large holdings.

Farm Holdings Largest Class of Ownership

About three-fourths of all private holdings of commercial forest land are farm forests (table 4). They number some 3,382,500 and represent about one-third of the total commercial forest land. Most of these farm forest ownerships are located in the North and South, with only about 64,000 in the West.

Table 3.--Number of private ownerships of commercial forest land by size class[1] on a State, and regional, sectional, or national basis, 1953 (United States and Coastal Alaska)

Section and region	State basis[1]			Regional, sectional, or national basis[2]	
	Small	Medium	Large	Medium	Large
	Number	Number	Number	Number	Number
North:					
New England	254,378	160	33	141	31
Middle Atlantic	764,124	239	24	239	24
Central	885,984	83	4	83	4
Lake	491,774	93	23	87	21
Plains	157,023	20	..	20	..
Total	2,553,283	595	84	563	75
South:					
South Atlantic	594,165	268	25	244	23
Southeast	777,620	893	83	827	82
West Gulf	453,712	331	64	308	57
Total	1,825,497	1,492	172	1,367	156
West:					
Pacific Northwest	83,696	191	33	186	30
California	10,307	141	16	141	16
Northern Rocky Mtn.	27,130	39	9	37	9
Southern Rocky Mtn.	7,687	58	11	56	11
Total	128,820	429	69	409	62
Coastal Alaska	286	..	..	..	..
All regions	4,507,886	2,516	325	2,330	283

1/ Size of an individual holding determined by area held within a given State. Small = 3 - 5,000 acres in East and 10 - 5,000 acres in the West. Medium = 5,000 - 50,000 acres. Large = more than 50,000 acres.

2/ Size of an individual holding determined by area held within a region, section, or country as a whole. Numbers of owners less on region than on State basis, and still less on section or national basis because of duplication of owners.

Table 4.--Number of private ownerships of commercial forest land, by type of ownership and section, 1953 1/ (United States and Coastal Alaska)

Type of ownership	All sections	North	South	West	Coastal Alaska
Forest industries:					
Lumber manufacturer	21,284	8,053	11,170	2,061	..
Pulp manufacturer	159	69	62	28	..
Other wood manufacturer	2,009	705	973	331	..
Total	23,452	8,827	12,205	2,420	..
Farm	3,382,502	1,928,752	1,389,804	63,946	..
Other private	1,104,773	616,383	425,152	62,952	286
Total, all private	4,510,727	2,553,962	1,827,161	129,318	286

1/ Estimates available only on State basis hence exceed totals shown on a sectional and national basis in table 2 for reasons illustrated in table 3 and accompanying text.

Forest industry holdings number about 23,450. About half of these properties of wood manufacturers are in the South, 40 percent in the North, and 10 percent in the West (table 4). They represent 13 percent of all commercial forest land. In terms of number as well as acreage held, lumber manufacturers represent the principal type of owner in the forest industries.

Other private forest holdings, comprising a wide variety of individuals, groups, and corporations, number about 1,104,800, or nearly one-fourth of all the forest owners (table 4). As in the case of farm forests, these miscellaneous private ownerships are concentrated in the North and South. They are second only to farm holdings in terms of acreage, with 27 percent of the total commercial forest land.

Most Private Lands Support Young-growth Stands

The privately owned lands in the United States and Coastal Alaska include a lower proportion of sawtimber stands, and more young-growth stands, than the public lands. Only 33 percent of the 358 million acres of private forests are classed as sawtimber stands, compared with 49 percent of the 130 million acres in public forests (table 5 and fig. 3). Many of the private sawtimber stands are second-growth, moreover, while public sawtimber stands include a large proportion of the remaining old-growth timber. In the national forests is found the highest proportion of sawtimber-stands--58 percent, with the lowest proportion of 11 percent on county and municipal lands. The differences between age and size of timber on private and public stands mainly reflect the heavier cutting that has taken place on the more accessible farm and other private forests, and the limited development of the relatively inaccessible national forest and other Federal lands in the West.

On a sectional basis, there is considerable variation in types of stands held by both private and public owners. Thus in the North and South only about 30 percent of the private holdings support sawtimber stands (table 4), essentially all of which are young-growth; in the West, 52 percent of the private stands are sawtimber. Public ownerships in the East likewise include relatively low proportions of sawtimber stands, and relatively large nonstocked areas, whereas in the West sawtimber stands cover 64 percent of the public holdings.

Sawtimber About Equally Distributed Between Private and Public Ownerships

As a result of the heavier cutting on private holdings, the 73 percent of the commercial forest land in private ownerships supports only 53 percent of the present sawtimber volume (table 6) and about 59 percent of the total growing stock (table 7). Farm forests are in relatively poor condition from the standpoint of sawtimber volume; they support only 15 percent of the present sawtimber volume though comprising one-third of the total commercial forest land (fig. 4). Industrial and other private holdings together constitute 40 percent of the total commercial forest land, but support about 38 percent of the total sawtimber volume.

Table 5.--Commercial forest land, by stand-size class, type of ownership, and section, 1953 (United States and Coastal Alaska)

Stand-size class	All sections						
	All owners	Private	Total public	National forest	Other Federal	State	County and municipal
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Sawtimber stands	37	33	49	58	56	22	11
Poletimber stands	35	38	25	24	21	34	29
Seedling and sapling stands	19	20	17	12	12	29	42
Nonstocked and other areas	9	9	9	6	11	15	18
All classes	100	100	100	100	100	100	100

Stand-size class	North		South		West		Coastal Alaska	
	Private	Public	Private	Public	Private	Public	Private	Public
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Sawtimber stands	30	16	31	35	52	64	84	95
Poletimber stands	39	34	41	38	25	20	11	2
Seedling and sapling stands	23	36	20	17	12	10	5	2
Nonstocked and other areas	8	14	8	10	11	6	..	1
All classes	100	100	100	100	100	100	100	100

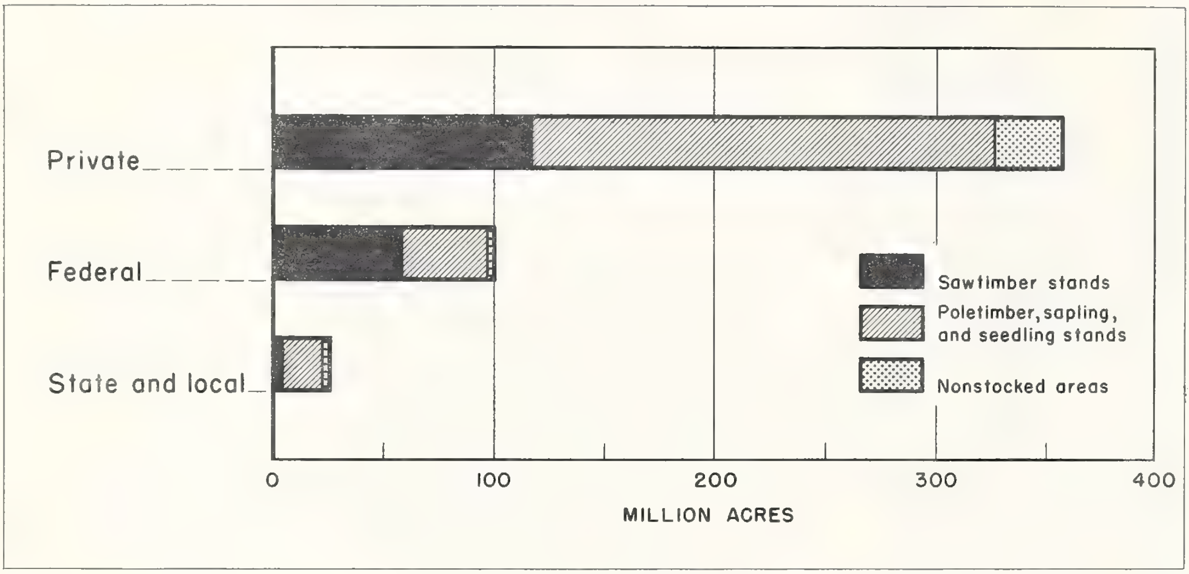

Fig. 3 - Ownership of commercial forest land by type of ownership and stand-size class, 1953.

Table 6.--Ownership of sawtimber, by section, 1953 (United States and Coastal Alaska)

Type of ownership	All sections		North	South	West	Coastal Alaska
	Volume	Proportion				
	Billion bd. ft.	Percent	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.
Private:						
Farm	308	15.0	102	144	62	..
Forest industries and other private	772	37.5	132	178	462	(1/)
Total	1,080	52.5	234	322	524	(1/)
Public:						
National forest	765	37.2	13	23	647	83
Indian 2/	45	2.2	2	(1/)	42	(1/)
Bur. Land Managem't. 2/	80	3.9	(1/)	(1/)	74	6
Other Federal	10	0.5	2	7	2	..
State	64	3.1	11	3	50	..
County and municipal	12	0.6	3	2	7	..
Total	977	47.5	32	35	821	89
All ownerships	2,057	100.0	266	357	1,345	89

1/ Less than 0.5 billion board feet.

2/ Because of different definitions of commercial forest land, and different cruising standards, specifications, and log rules, estimates for these ownerships may vary from published figures of the public agencies concerned.

Table 7.--Ownership of sawtimber and growing stock, by softwoods and hardwoods, 1953
(United States and Coastal Alaska)

Type of ownership	Sawtimber				Growing stock			
	Total	Proportion	Softwoods	Hardwoods	Total	Proportion	Softwoods	Hardwoods
	Billion bd. ft.	Percent	Billion bd. ft.	Billion bd. ft.	Billion cu. ft.	Percent	Billion cu. ft.	Billion cu. ft.
Private:								
Farm	308	15.0	140	168	103	19.9	..	..
Forest industries and other private	772	37.5	578	194	201	38.9	..	..
Total	1,080	52.5	718	362	304	58.8	..	..
Public:								
National forest	766	37.2	740	26	163	31.5	152	11
Other Federal	135	6.6	127	8	28	5.4	25	3
State	64	3.1	54	10	18	3.5	..	..
County and municipal	12	.6	9	3	4	.8	..	..
Total	977	47.5	930	47	213	41.2	..	..
All ownerships	2,057	100.0	1,648	409	517	100.0	355	162

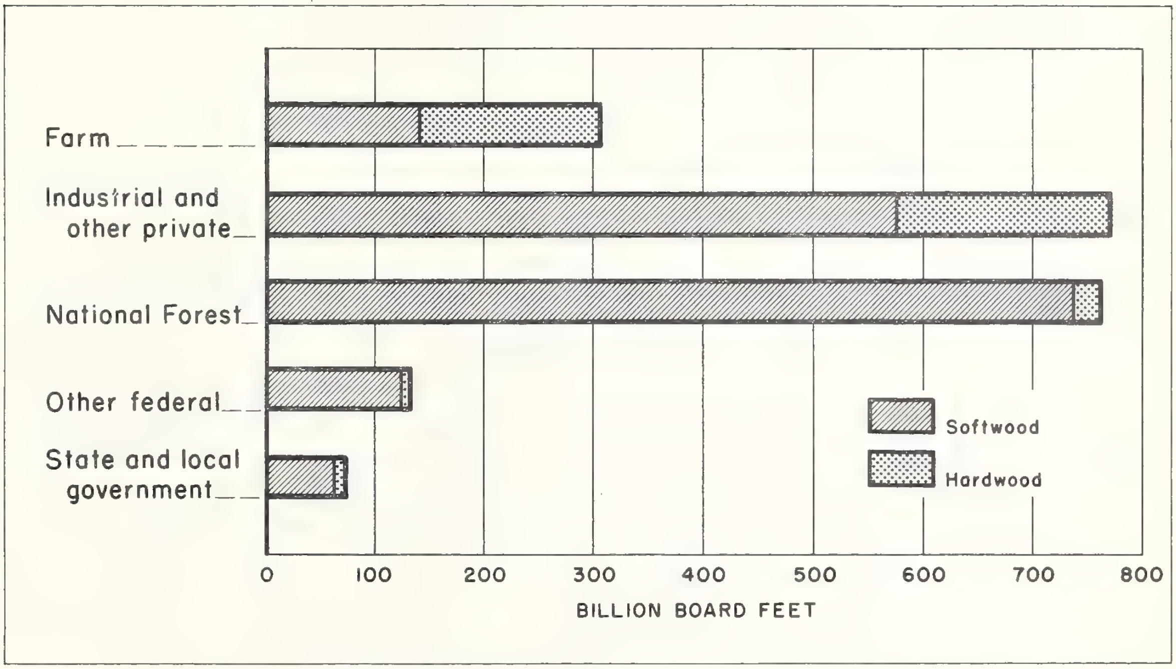

Fig. 4 - Net volume of live sawtimber on commercial forest land in the United States and Coastal Alaska, by type of ownership, softwood and hardwood, 1953.

The national forests contain a high proportion of the present volume of sawtimber. Although these public lands account for only 17 percent of the commercial forest area, they contain 37 percent of the total sawtimber volume. State and other local public holdings include about 10 percent of the sawtimber.

As in the case of forest areas, private holdings include most of the sawtimber in the North and the South—about 90 percent of the total (table 6). In the West, on the other hand, about 60 percent of the sawtimber is on public lands, with 48 percent of the western sawtimber in the national forests alone. Most of the sawtimber in Coastal Alaska also is found on national forest lands.

Over Half the Softwood Sawtimber on Public Lands

Distribution of ownerships of softwood sawtimber is of large significance since softwood species make up close to four-fifths of all timber products cut in the United States and nearly as large a proportion of prospective requirements. At the present time, private forests support only 44 percent of the softwood sawtimber (table 7). About 45 percent of the total softwood sawtimber volume is found on the national forests, and 11 percent on other public holdings.

While this distribution of volume implies large dependence on public timber in the immediate future, in the long run when the cut is obtained solely from second-growth stands it is to be expected private forests will contribute more in proportion to their area, and thus supply as much as 73 percent or even more of the prospective future growth.

Present hardwood sawtimber resources, unlike the softwoods, are mainly found on private lands. About 41 percent of the hardwood sawtimber volume is on farms, 47 percent on other private lands, and only 12 percent in public holdings.

Problems Relate to Both Type and Size of Owners

Some of the problems of forest land management reflect the characteristics of the owners of forest land, while other problems are attributable primarily to size of holdings. Both type of ownership and size of holdings, and possible relationships between these factors, must be considered in appraising forest conditions and programs. Forest industry ownerships, for example, are considered to differ in many important respects from the large groups of farm and "other" private ownerships and consequently are discussed separately in the following sections of this report.

Holdings of Lumber Manufacturers Predominate

Lumber companies, pulp companies, and other primary manufacturers of wood products together hold 62 million acres, or about 13 percent of the commercial forest area (table 8). Lumber manufacturers represent the largest class of forest industry with 35 million acres, or 56 percent of all forest industry lands. Pulp companies own 23 million acres, or about 37 percent of these industrial holdings, and other wood manufacturers own 4.4 million acres, or 7 percent of the total. As indicated in table 4, there are an estimated 23,452 forest industry ownerships in the United States, including 21,284 lumber manufacturers, 159 pulp companies, and 2,009 manufacturers of other wood products.

Industrial Lands Chiefly in Large and Medium-sized Holdings

About two-thirds of the commercial forest land held by forest industries, or 42 million acres, is in "large" ownerships of more than 50,000 acres (table 8 and fig. 5). "Medium" holdings total 16 million acres, or one-fourth of the industrial forest area. "Small" holdings of less than 5,000 acres account for only 6 million acres, or 10 percent of these industry lands.

The holdings of pulp companies are nearly all in large ownerships. About half the lands of lumber manufacturers and a third of the area held by other wood manufacturers are in large holdings. A general concentration in large and medium-sized holdings is evident in all sections (fig. 5) and in all regions except the Central States (table 9).

Industrial Holdings Concentrated in the South

Somewhat more than half of the 62 million acres owned by forest industries is located in the South (table 10 and fig. 5). The balance of the area is divided about equally between the North and the West. Concentration of industrial holdings in the South is characteristic of all the forest industries, each having about half its lands in this area. Extensive holdings of lumber manufacturers are also found in the West, with relatively small holdings in the North. Holdings of pulp companies and other wood manufacturers, on the other hand, are more extensive in the North than in the West.

Little information is available to indicate timber volumes present on the lands of forest industries as distinct from other nonfarm holdings. Forest industry lands account for 13 percent of all commercial forest land but it is believed they support a larger fraction of the timber volume. Considerable areas of old-growth timber in the western States are held in industrial ownerships. In many cases, forest industries in recent years have attempted to minimize cutting on company lands in order to build up the quantity and quality of timber on their holdings.

Table 8.--Area owned and proportion of commercial forest land, by private owner class and size of holdings, 1953 (United States and Coastal Alaska)

AREA OWNED

Type of ownership	Total	Less than 100 acres	100-500 acres	500-5,000 acres	5,000-50,000 acres	Over 50,000 acres
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
Forest industries:						
Lumber manufacturer	34,687	467	1,905	3,137	10,634	18,544
Pulp manufacturer	23,276	..	..	147	1,278	21,851
Other wood manufacturer	4,419	23	225	137	2,451	1,583
Total	62,382	490	2,130	3,421	14,363	41,978
Farm	165,217	77,781	59,219	23,132	4,534	551
Other private	130,670	42,752	36,533	19,825	15,772	15,788
Total, all private	358,269	121,023	97,882	46,378	34,669	58,317

PROPORTION OF COMMERCIAL FOREST

Type of ownership	Total	Less than 100 acres	100-500 acres	500-5,000 acres	5,000-50,000 acres	Over 50,000 acres
	Percent	Percent	Percent	Percent	Percent	Percent
Forest industries:						
Lumber manufacturer	7.1	0.1	0.4	0.6	2.2	3.8
Pulp manufacturer	4.8	..	..	(1/)	.3	4.5
Other wood manufacturer	.9	(1/)	(1/)	(1/)	.5	.4
Total	12.8	.1	.4	.6	3.0	8.7
Farm	33.8	15.9	12.1	4.8	.9	.1
Other private	26.7	8.7	7.5	4.1	3.2	3.2
Total, all private	73.3	24.7	20.0	9.5	7.1	12.0

1/ Less than 0.1 percent.

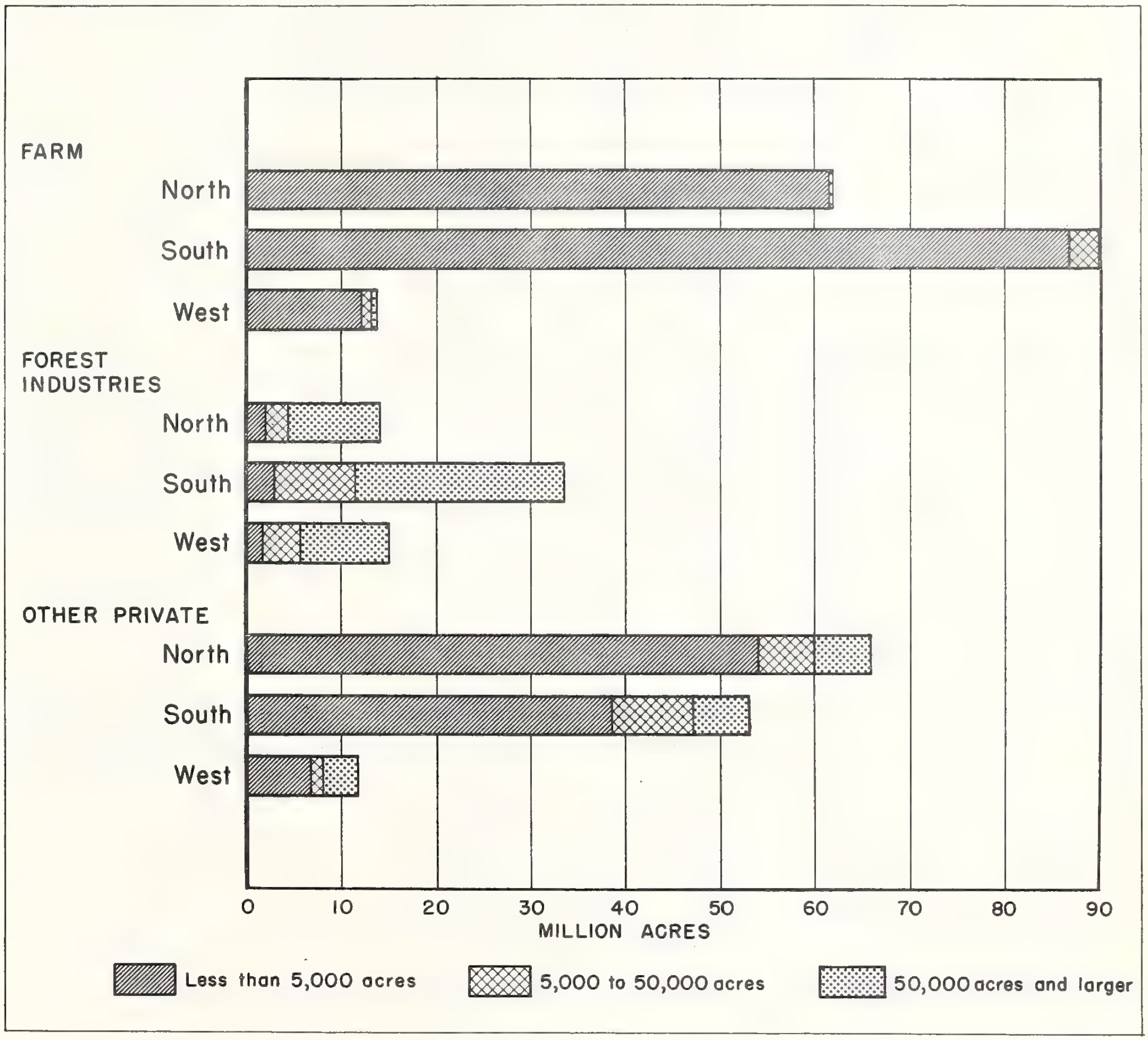

Fig. 5 – Ownership of private commercial forest land in the continental United States, by type of ownership and size of holding, 1953

Table 9.--Area of commercial forest land owned by forest industries, by region and size class of ownership, 1953[1]
(United States and Coastal Alaska)

Section and region	Total commercial forest land	Forest industry ownerships: Total	Under 100 acres	100 - 500 acres	500 - 5,000 acres	5,000 - 50,000 acres	Over 50,000 acres
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
North:							
New England	30,658	8,178	61	198	371	1,023	6,525
Middle Atlantic	42,225	2,069	59	228	284	493	1,005
Lake States	53,272	3,039	36	62	102	639	2,200
Central	42,394	817	56	66	347	97	251
Plains	5,492	..	..	..	..	..	..
Total	174,041	14,103	212	554	1,104	2,244	9,989
South:							
South Atlantic	46,152	5,614	109	583	226	1,518	3,178
Southeast	94,985	15,443	96	299	626	4,600	9,822
West Gulf	52,151	12,466	49	383	356	2,353	9,325
Total	193,288	33,523	254	1,265	1,208	8,436	22,360
West:							
Pacific Northwest	45,365	8,880	24	231	503	2,083	6,039
California	17,317	3,389	..	55	231	1,486	1,617
Northern Rocky Mtn.	33,840	2,331	..	21	351	251	1,708
Southern Rocky Mtn.	20,489	156	..	4	24	6	122
Total	117,011	14,756	24	311	1,109	3,792	9,520
Coastal Alaska	4,269	..	..	..	..	..	..
All regions	488,609[2]	62,382	490	2,130	3,421	14,363	41,978

1/ Area in a given size class on a regional basis does not add to sectional or national totals because holdings of a given owner located in different regions have been combined in determining size class of ownerships on a sectional basis.

2/ Area owned by forest industries in Coastal Alaska was not reported.

Table 10.--Area of commercial forest land owned by forest industries, by region and type of industry, 1953 (Continental United States)

Section and region	Total forest industries	Lumber manu-facturer	Pulp manu-facturer	Other wood manu-facturer
	Thousand acres	Thousand acres	Thousand acres	Thousand acres
North:				
New England	8,178	1,002	6,840	336
Middle Atlantic	2,069	977	889	203
Lake States	3,039	1,435	1,495	109
Central	817	541	..	276
Total	14,103	3,955	9,224	924
South:				
South Atlantic	5,614	2,620	2,603	391
Southeast	15,443	6,587	6,963	1,893
West Gulf	12,466	9,310	2,622	534
Total	33,523	18,517	12,188	2,818
West:				
Pacific Northwest	8,880	6,858	1,681	341
California	3,389	3,076	173	140
Northern Rocky Mtn.	2,331	2,131	10	190
Southern Rocky Mtn.	156	150	..	6
Total	14,756	12,215	1,864	677
All regions 1/	62,382	34,687	23,276	4,419

1/ Area owned by forest industries in Coastal Alaska was not reported.

Area of Industrial Holdings Shows Moderate Increase

In recent years, many pulp companies and certain other primary wood manufacturers have adopted aggressive land acquisition programs. Between 1945 and 1953, for example, pulp company holdings increased by 8.5 million acres. In the same period, however, lumber company holdings declined by nearly 2 million acres, largely through transfer to pulp companies. The net acquisition of 6.6 million acres by pulp and lumber manufacturers combined in the 8-year period 1945-53 thus amounted to an increase of 13 percent.

The comparatively small acreage of land held by primary wood manufacturers partly reflects historical practices of obtaining timber from other private land and from public lands through contract or open market purchases of stumpage, logs, pulpwood, or other products. Most small sawmill operators, for example, own no timberlands, and the major part of the United States' pulpwood cut is obtained from nonindustry lands. For many years, lumber manufacturers also have disposed of timberlands by sale for agricultural or other purposes, by allowing cutover lands to revert to local governments through tax delinquency, by selling timberlands to the Federal Government, or exchanging private land for public timber--a practice which the Government has now largely ceased. Only recently have profit possibilities in the growing of timber crops, and the need to hold timberlands for protection of permanent plant investments, become generally recognized throughout the forest industries.

Productivity of Forest Industry Holdings Relatively High

Management practices as indicated by ratings of productivity of recently cut lands are relatively good on forest industry holdings. On pulp company lands, 84 percent of the recently cut area was rated "high" productivity, 15 percent "medium," and only 1 percent "low" (table 11 and fig. 6).[2] On holdings of lumber and other wood manufacturers, the record was nearly as favorable. On these holdings, about 73 percent of the recently cut area was rated "high" and only about 5 percent "low" in productivity. Within each industry, relatively little difference in ratings was evident from section to section, except for relatively low ratings for lands owned by pulp and other wood manufacturers in the North:

Section	Lumber manufacturer			Pulp manufacturer			Other wood manufacturer		
	High	Medium	Low	High	Medium	Low	High	Medium	Low
	Percent of area								
North	68	24	8	66	33	1	53	38	9
South	69	23	8	96	4	(1/)	78	22	(1/)
West	78	19	3	94	1	5	73	9	18
All regions	73	21	6	84	15	1	73	23	4

1/ Less than 0.5 percent.

Ratings of productivity of recently cut lands on forest industry properties averaged higher on the medium and large holdings than on the limited areas of small industrial ownerships (table 12). In practically all cases, productivity ratings for industry holdings were also substantially better than the productivity ratings for farm and other private holdings, which currently supply forest industries with the major part of their raw-material requirements. Such differences are believed to reflect a widespread interest in permanent timber growing on the lands of the forest industries and the fact that small sawmill operators, pulpwood contractors, and other loggers generally cut purchased timber on farm and other private forests with less care than used in cutting timber on "company" lands. Farmers and other private owners usually sell their timber without cutting restrictions, and in such cases logging operators frequently leave the land in relatively poor condition for continued timber production.

2/ For a detailed discussion of concepts and findings relating to productivity, see section on "Condition of Recently Cutover Lands," Chapter IV.

Table 11.--Productivity of recently cut commercial forest lands, by type of ownership[1/] (United States and Coastal Alaska)

Type of ownership	Proportion of area by productivity class		
	High	Medium	Low
	Percent	Percent	Percent
Private:			
Forest industries:			
Lumber manufacturer	73	21	6
Pulp manufacturer	84	15	1
Other wood manufacturer	73	23	4
Average	77	19	4
Farm	41	37	22
Other private	52	28	20
Average	56	29	15
Public:			
National forest	81	16	3
Bureau of Land Management	80	15	5
Indian	74	25	1
Other Federal	80	16	4
State	77	18	5
County	76	24	..
Municipal and local	93	6	1
Average	80	17	3
All ownerships	65	24	11

1/ Recently cut lands (or operating area) in an ownership is the area of forest types in which there was some commercial cutting in the period 1947-54.

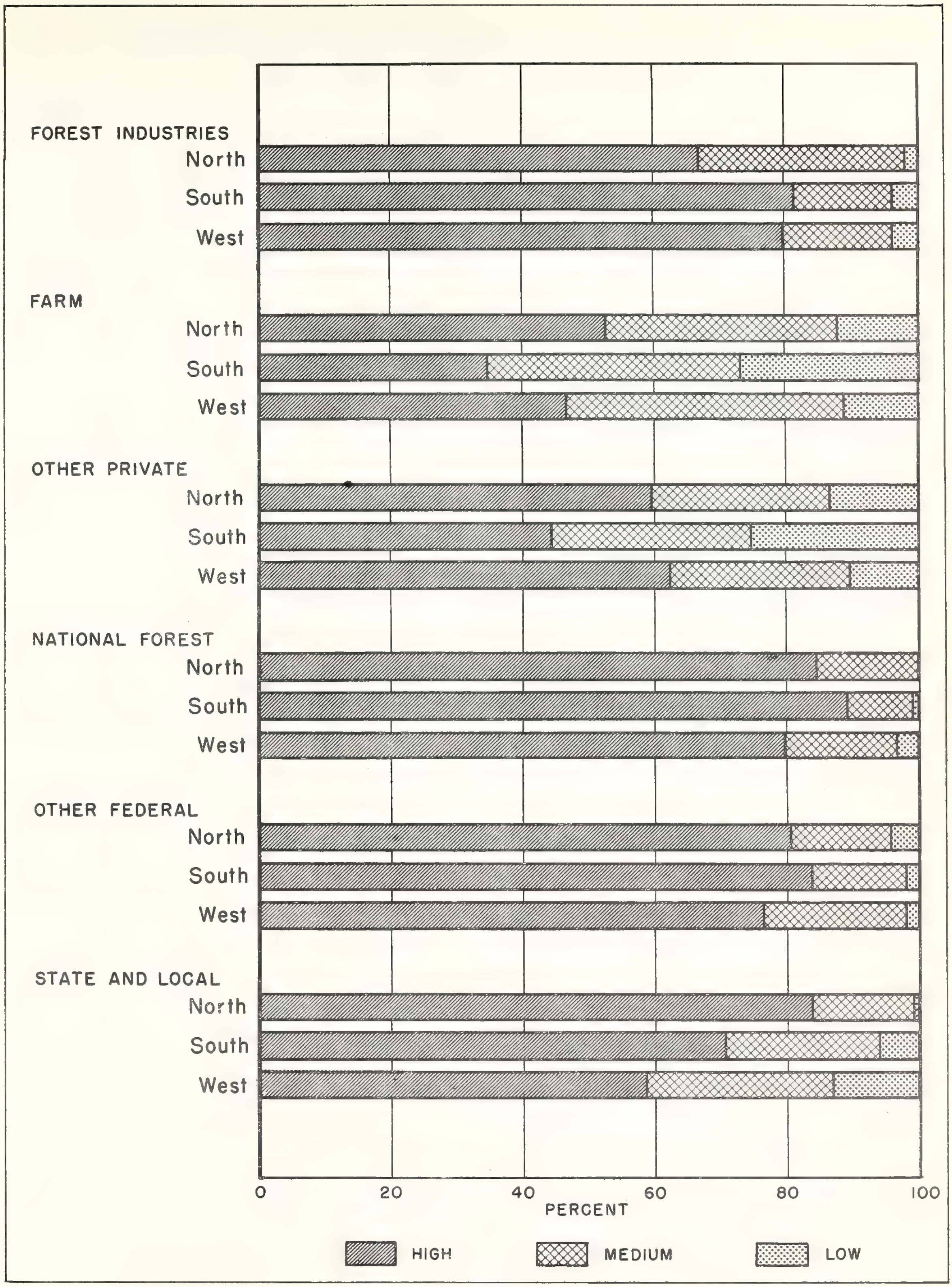

Fig. 6 - Productivity of recently cut commercial forest land by type of ownership and section, 1953

Table 12.--Productivity of recently cut private commercial forest lands, by type of ownership and size class of ownership[1/]
(Continental United States)

Size and productivity classes	Private ownerships	Forest industries: Total	Forest industries: Lumber manufacturer	Forest industries: Pulp manufacturer	Forest industries: Other wood manufacturer	Farm	Other private
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Less than 5,000 acres:							
High	40	48	48	22	62	40	41
Medium	36	36	35	75	38	38	32
Low	24	16	17	3	..	22	27
5,000 - 50,000 acres:							
High	64	74	74	79	73	55	56
Medium	26	20	20	12	24	29	31
Low	10	6	6	9	3	16	13
More than 50,000 acres:							
High	78	81	78	84	74	84	69
Medium	18	17	19	15	18	16	21
Low	4	2	3	1	8	..	10
All size classes:							
High	56	77	73	84	73	41	52
Medium	29	19	21	15	23	37	28
Low	15	4	6	1	4	22	20

1/ Recently cut lands (or operating area) in an ownership is the area of forest types in which there was some commercial cutting in the period 1947-54.

Management Programs Adopted by Forest Industry

In an effort to improve both the quantity and quality of timber growth, many pulp companies and certain other forest industry owners have been investing in stand improvement through such measures as girdling or poisoning cull trees and release cutting in both natural and planted stands. Thus, in the period 1947-53, 45 percent of the pulp manufacturing companies, with 58 percent of all pulp company lands, were applying some form of stand improvement on a portion of their ownerships other than areas with recent commercial cuttings. This was considerably in excess of the efforts by lumber companies and far more than the average of 2 percent of all private owners. Stand improvement efforts were especially important on pulp company lands in the South.

Forest industries are also making a large contribution to fire protection on their lands by supplementing the efforts of public fire control agencies. In 1952, private expenditures for fire control, derived to a large extent from industrial forest owners, amounted to $10,500,000 or 17 percent of all expenditures for organized fire control.

To an increasing degree, the larger private timber owners are also cooperating in the detection and control of insects and disease, and in many areas forest industry is salvaging timber killed by insects or other destructive agents.

Tree planting programs of forest industries have also been steadily expanding. In 1953, the forest industries in the United States planted 220,000 acres, or 31 percent of the total area of new plantations. Industry plantings totaling about 1 million acres represented 12 percent of the total area planted up to and including 1953. About 90 percent of the industry plantings in 1953, and three-fourths of all existing plantations, were located in the South.

For the country as a whole, however, acceptable plantations in 1952 totaled only 5.2 million acres, while the plantable area amounted to about 52 million acres. The future need for planting applies in all sections and all ownerships.

Several Factors Favor Industrial Forestry

The rapid expansion of forestry programs by the timber industries reflects an increasing recognition of the present and prospective profitability of timber growing in favorable areas. In many cases, acquisition of land, tree planting, and other forestry programs also have been greatly accelerated in order to protect permanent large investments in pulp mills and other plants by providing dependable future supplies of raw materials. As on other private lands, expanded tree planting and intensive forestry have been greatly promoted by the large improvements effected in protection of forest land against fire. Adequate capital in general has been readily available to the forest industries for land acquisition and improvement. Stability of land tenure through corporate organization, and integration of timber

growing with utilization in pulp mills and other manufacturing plants, also represent significant reasons for the widespread growth of industrial forestry.

Outstanding progress has been made by industries in the South and Pacific Northwest where timber growing, production, and market factors have been relatively favorable, but all sections have shared in the advance of industrial forestry.

Further expansion of industry holdings faces certain problems, such as the increasing difficulty of acquiring timber tracts of substantial size, and a large increase in forest land prices. In some areas, moreover, considerable local opposition has developed toward large company acquisition. The pulp industry in some cases has attempted to meet this problem by maintaining a market for wood produced by farmers and other small owners, by the sale to small local sawmills or other local wood users of sawtimber produced on company lands, and by providing technical forestry assistance to small landowners and timber operators.

Although relatively limited in area with only 13 percent of the commercial forests, the lands of forest industries include some of the most accessible, productive, and well-managed forests and a significant part of the Nation's timber resource. These industrial ownerships, therefore, must be counted on to supply a sizeable share of the Nation's future wood requirements.

Industry ownership may also be of even larger significance through demonstration, education, and assistance to other private forest landowners who supply most of the raw material for wood-using plants. The forest industries also are in a position to influence the cutting practices of independent logging operators who cut timber on farm and other private forest ownerships for delivery to wood-manufacturing plants.

FARM AND OTHER PRIVATE OWNERSHIPS

The characteristics of the owners of farm and miscellaneous "other" private holdings, the forest problems which they face, and opportunities open to them in general differ from those of public and forest industry owners. Farm and other private ownerships constitute a large and heterogeneous group, comprised of cropfarmers and livestock ranchers, business and professional people, housewives, wage earners, mining and land holding companies, and a wide variety of other miscellaneous owners. Some manage their lands for production of stumpage. Some operate wood-using plants but derive most of their income from non-timber sources and hence are included in this category. Most of these farm and other private owners, however, are interested primarily in occupations other than timber growing and manufacture. In terms of area and potential yields, they represent the principal class of forest ownership.

Farm and Other Private Ownerships Include Three-fifths of Commercial Forest Land

The commercial forest land in farms and private ownerships other than forest industries amounts to 296 million acres, or 61 percent of the total commercial forest area in the United States and Coastal Alaska (table 1).

Farm holdings, which include lands owned both by farm operators and by other private owners who lease lands to farm operators, represent the largest class of forest ownership. Farm forests total 165 million acres, or 34 percent of the total commercial forest land.3/ "Other" private ownerships include 131 million acres, or nearly as much as the farm holdings.

In the South are found close to half of the farm and other private holdings--143 million acres (table 13). There is also a large concentration of 128 million acres of these private holdings in the North. The western regions include only 25 million acres of farm and other private holdings. The acreage of private ownerships in Coastal Alaska is negligible.

Farm holdings are particularly numerous in the Central States and South Atlantic regions where they account for more than half of the commercial forest land (fig. 7). In the northeastern States, other private owners hold more than half of the commercial forest area (fig. 8).

Farm and Other Private Holdings Mostly Small

There are approximately 3.4 million farm forest ownerships in the United States and 1.1 million other private ownerships, or a total of 4,487,000 separate holdings (table 14). About 57 percent of these holdings are in the North, 40 percent in the South, and 3 percent in the West (table 4). In both North and South, farm owners considerably exceed the numbers of other private owners, whereas the numbers are about equal in the West.

"Small" holdings of less than 5,000 acres in farm and "other" private ownerships aggregate about 259 million acres, or 88 percent of all commercial forest lands in these ownership classes (table 14). "Medium" holdings of 5,000 to 50,000 acres include only 20 million acres. "Large" ownerships of more than 50,000 acres contain 16 million acres, most of which are nonfarm holdings.

The farm ownerships on a nationwide basis average only 49 acres in size. The average farm holding in the North is considerably smaller

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3/ An increase in estimated area of farm ownership from 139 million acres in the 1945 Reappraisal to 165 million acres, and a decrease of "other" private holdings from 155 to 131 million acres, is believed to be attributable largely to changes in definitions of farms and farm woodlands.

Table 13.--Number and area of farm and "other" private ownerships of commercial forest land, by section and region, 1953 (United States and Coastal Alaska)

Section and region	Total farm and other private		Farm		"Other" private	
	Ownerships	Area	Ownerships	Area	Ownerships	Area
	Thousands	Million acres	Thousands	Million acres	Thousands	Million acres
North:						
New England	252	21	94	6	158	15
Middle Atlantic	762	35	544	12	218	23
Lake States	491	29	371	15	120	14
Central	883	38	767	24	116	14
Plains	157	5	153	4	4	1
Total	2,545	128	1,929	61	616	67
South:						
South Atlantic	591	36	475	30	116	6
Southeast	774	72	617	46	157	26
West Gulf	450	35	298	14	152	21
Total	1,815	143	1,390	90	425	53
West:						
Pacific Northwest:						
Douglas-fir subregion	66	6	39	3	27	3
Pine subregion	16	4	6	2	10	2
Total	82	10	45	5	37	5
California	10	5	3	2	7	3
Northern Rocky Mtn.	27	6	11	4	16	2
Southern Rocky Mtn.	8	4	5	3	3	1
Total	127	25	64	14	63	11
Coastal Alaska	(1/)	(1/)	..	..	(1/)	(1/)
Total, all regions	4,487	296	3,383	165	1,104	131

1/ Includes 286 "other" private owners with 19,000 acres of commercial forest land.

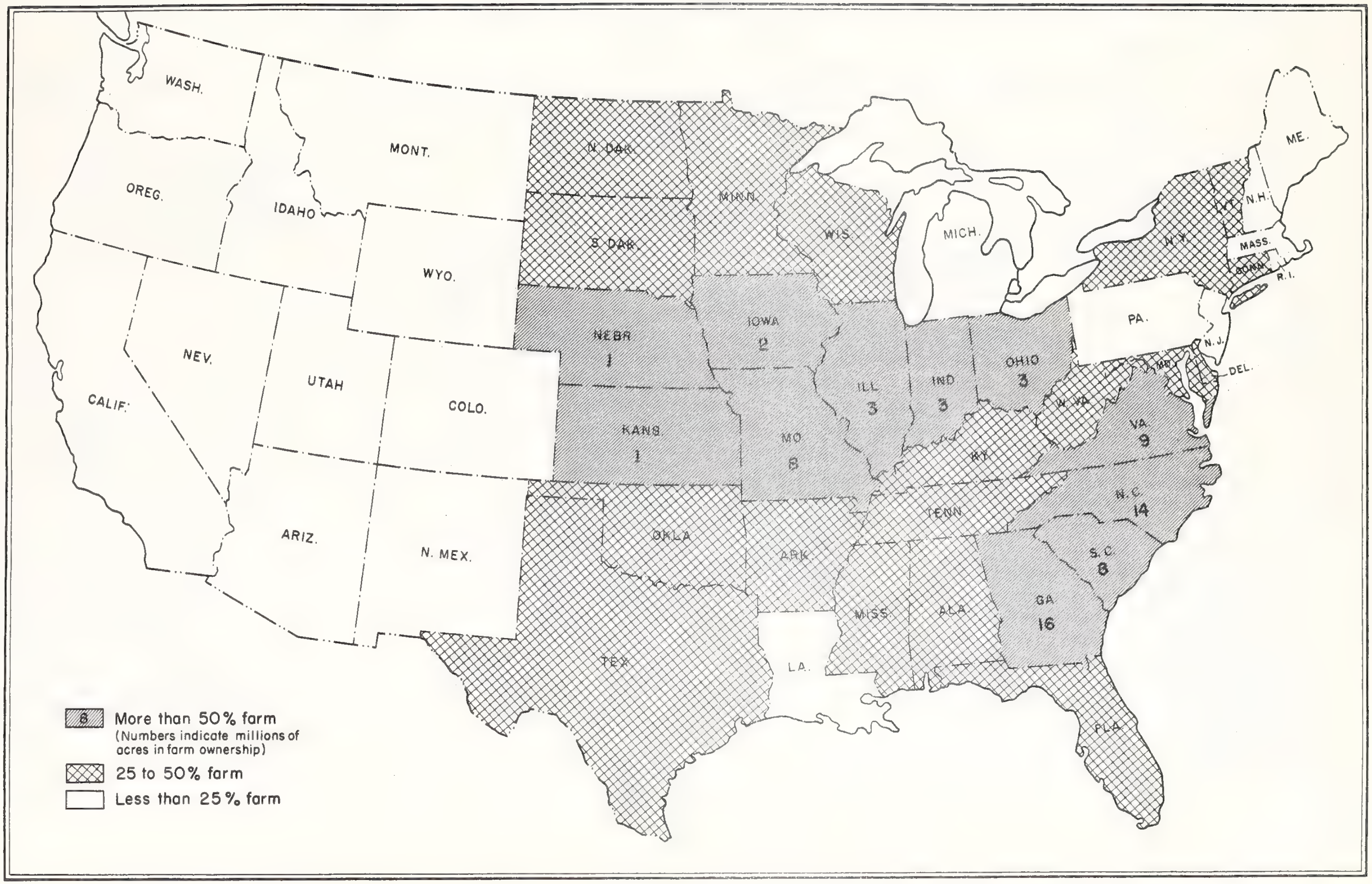

Fig. 7 - In many central and southeastern states, more than half of the commercial area is in farm ownerships.

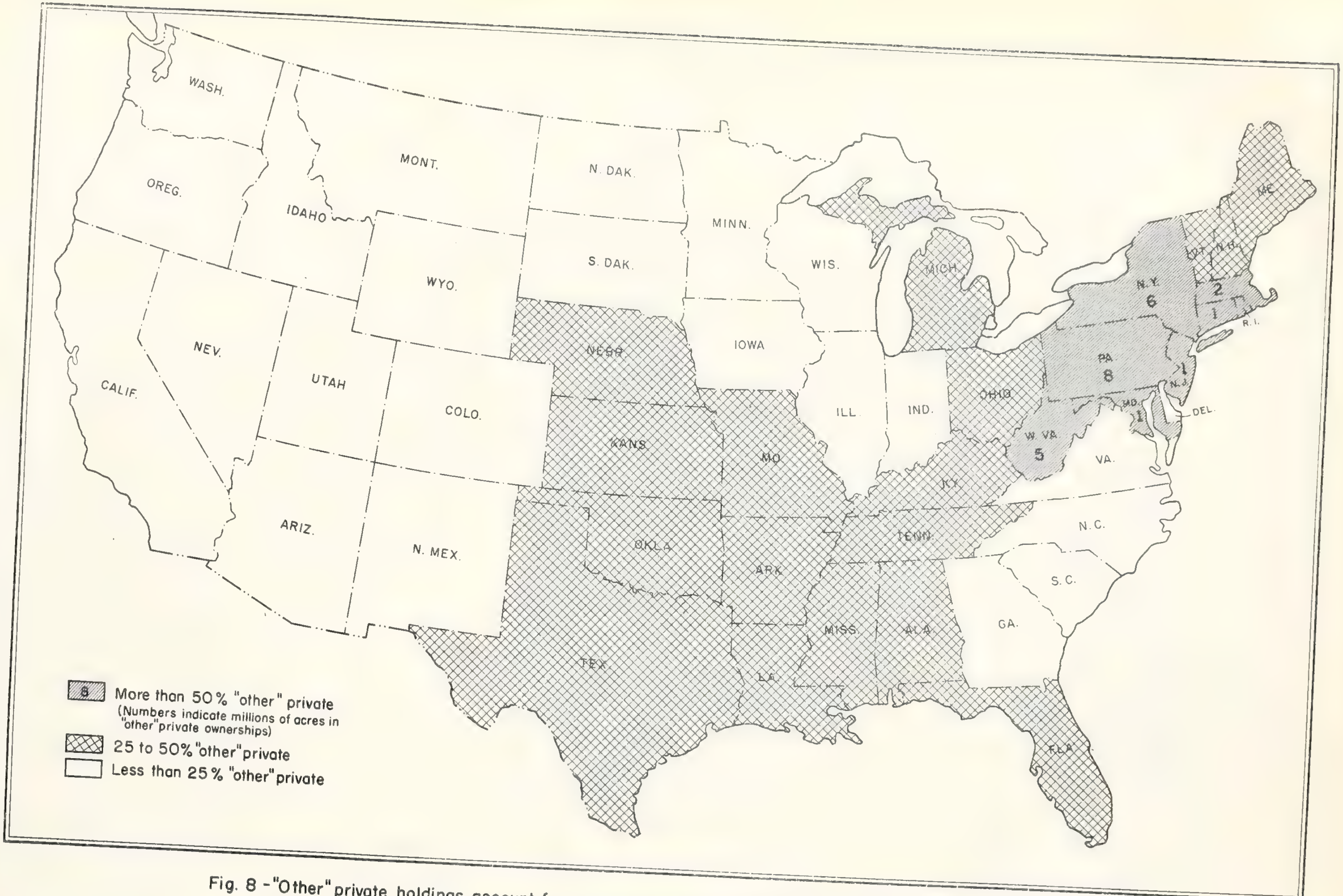

Fig. 8 - "Other" private holdings account for more than half of the total commercial forest area in the Middle Atlantic States and southern New England.

Table 14.--Number of farm and "other" private forest ownerships of commercial forest land and area owned, by size of holding, 1953 (United States and Coastal Alaska)

Size of holding (acres)	Total farm and other private		Farm		Other private	
	Ownerships	Area	Ownerships	Area	Ownerships	Area
	Thousands	Thousand acres	Thousands	Thousand acres	Thousands	Thousand acres
Less than 10 1/	796	5,058	671	4,163	125	895
10 to 20	864	12,168	742	10,239	122	1,929
20 to 30	580	13,699	485	11,205	95	2,494
30 to 40	361	12,390	279	9,386	82	3,004
40 to 50	342	15,288	197	8,453	145	6,835
50 to 75	499	30,071	324	18,734	175	11,337
75 to 100	375	31,849	193	15,601	182	16,248
Total, less than 100 2/	3,817	120,523	2,891	77,781	926	42,742
100 to 500	)	95,752	)	59,219	)	36,533
500 to 5,000	) 670	42,957	) 492	23,132	) 178	19,825
5,000 to 50,000	)	20,306	)	4,534	)	15,772
50,000 and larger	)	16,339	)	551	)	15,788
All holdings 2/	4,487	295,877	3,383	165,217	1,104	130,660

1/ East only.
2/ Excludes 10,000 acres in Coastal Alaska for which breakdown was not available.

than average with 32 acres, while in the South farm forests average 65 acres, and in the West 219 acres (tables 1 and 4). "Other" private holdings average 119 acres for the country as a whole—over twice the average area of farm forests. In the North, "other" private holdings average 109 acres, in the South 125 acres, and in the West 175 acres.

Holdings of Less Than 100 Acres Predominate

The very small holdings of less than 100 acres account for 3.8 million out of 4.5 million holdings, or 84 percent of the total number of farm and "other" private ownerships (table 14). They include about 121 million acres, or 40 percent of the total area in this large ownership class. Nationwide, these holdings of less than 100 acres represent one-fourth of all commercial forest lands, or approximately as much as all public holdings combined.

Nearly half of the total acreage of farm ownerships is in holdings of less than 100 acres, with an especially large proportion of 64 percent in the North and a low proportion of 14 percent in the West, as shown by the following tabulation:

Size of farm holding (acres)	United States (percent)	North (percent)	South (percent)	West (percent)
Less than 100	47	64	41	14
100 to 500	36	32	39	32
500 to 5,000	14	4	16	41
5,000 to 50,000	3	(1/)	4	9
50,000 and larger	(1/)	..	..	4
Total	100	100	100	100

1/ Less than 0.5 percent.

As indicated above, significant numbers of medium and large farm forest holdings are found only in the West.

"Other" private holdings have only about one-third of the total acreage in ownerships of less than 100 acres, as shown by the following tabulation:

Size of "other" private holding (acres)	United States (percent)	North (percent)	South (percent)	West (percent)
Less than 100	33	46	21	12
100 to 500	28	26	30	27
500 to 5,000	15	10	22	17
5,000 to 50,000	12	9	16	13
50,000 and larger	12	9	11	31
Total	100	100	100	100

As indicated above, large and medium-size ownerships are found in all sections, with the West having the highest proportions in large ownerships.

Half the Farm and "Other" Private Ownerships Include 6 Percent of Commercial Forest Land

Ownerships of less than 30 acres number about 2.2 million, or half the total number of all farm and "other" private holdings, but these very small ownerships account for only 6 percent of the total area of commercial forest land, as shown below:

Size of holding	Farm and "other" private ownerships, cumulative (thousands)	(percent)	Percent of total commercial forest land, cumulative
Under 10 acres	796	18	1
Under 20 acres	1,660	37	4
Under 30 acres	2,240	50	6
Under 40 acres	2,601	58	9
Under 50 acres	2,943	66	12
Under 75 acres	3,442	77	18
Under 100 acres	3,817	85	25
All holdings	4,487	100	61

The small size of holdings that characterizes farm and "other" private ownerships may represent a real obstacle to attainment of intensive forest management. Incomes from such small holdings are necessarily limited and usually infrequent. Small forests cannot support full-time timber managers and must of necessity be managed as sideline enterprises.

Where forestry assistance programs require personal contact with forest owners, problems also arise because of the large number of owners and the relatively high cost per contact. When resources available for such assistance are limited, the question of priorities may be of importance. Priorities might be given to areas of low productivity, for example, or to owners of softwood-producing lands. But programs also might be made more effective by concentrating assistance that requires personal contact on holdings above some minimum acreage.

Thus, if farm and other private holdings under 30 acres were excluded from the priority group of owners, half of all the farm and other private owners, or 2,240,000 holdings, could be left out with a loss of coverage of only 6 percent of the total commercial forest land. Some production from the smaller properties could be expected in any case, and concentration of efforts on the larger holdings might significantly increase output on these more productive lands.

Farm Forests Support Relatively Low Timber Volumes

The commercial forest lands in farm ownerships comprise 34 percent of all commercial forest lands but contain only 15 percent of the present sawtimber volume and 20 percent of the total growing stock (tables 6 and 7). On the average, they support only 1,900 board feet per acre, compared with 4,000 board feet for "industrial and other private" holdings, and 4,200 board feet for all ownerships. Although farm holdings in general are accessible and of relatively good timber-growing quality, they are in comparatively poor condition.

Information regarding timber volumes on "other" private lands is available only for the combined holdings of forest industries and other private owners--partly because of the difficulty of collecting accurate data and because differences in owner categories have only recently been considered of primary importance. These lands support considerably larger volumes on the average than do farm holdings, as indicated above. They account for nearly 40 percent of the commercial forest land and together include 38 percent of all the present sawtimber. Although industrial holdings are believed to support heavier volumes on the average than the "other" private holdings, the fact that the latter make up about two-thirds of these combined holdings suggests that they too support significantly heavier stands of sawtimber than the farm holdings.

Private Ownerships Are a Heterogeneous Group

Farm forest ownership is associated with many types of crop and livestock farming, but in terms of occupations and interests farm forest owners constitute a relatively homogeneous group. The miscellaneous "other" private owners, on the other hand, are extremely varied as to occupation, residence, intent of ownership, and interest in forestry. Although management decisions of these miscellaneous owners undoubtedly are affected by such characteristics, which factors are of most importance from the standpoint of designing forestry programs is not fully known at this time.

Other Private Ownerships Represent Many Occupations

The diversity of occupations of "other" private forest landowners, as determined by independent ownership studies in a number of sample areas, is illustrated in table 15. Although definitions used in these studies differ somewhat and percentages consequently are not strictly comparable, in all of the areas studied business and professional people constituted the principal class of other private owner in terms of forest area held. This was also frequently true in terms of number of owners. Included in business and professional classes were lawyers, teachers, physicians, merchants, salesmen, bankers, owners of recreational resorts, and other businesses.

Wage earners constituted the second most important group of owners in most of the study areas. Housewives were third in importance in many areas. Retired persons likewise were of considerable importance, although the classification used in some studies did not include

Table 15.--Distribution of number of "other" private owners of commercial forest land and of areas owned, by occupational groups in selected areas of the United States 1/

Occupational group	23 New England towns 2/		Tennessee Valley 3/		Central Mississippi 4/		5 areas in Ark., La., and Miss. 5/		Northwest California 6/	
	Owners	Area	Owners	Area	Owners	Area	Owners	Area	Owners	Area
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Business and professional people	31.3	36.7	23.5	35.9	18.4	48.1	38.6	51.4	38.5	68.0
Wage and salary earners	27.0	14.5	50.4	26.4	57.5	18.5	24.8	17.2	22.5	5.8
Housewives	15.1	10.5	19.3	15.1	18.0	23.8	22.9	17.0	7.2	2.9
Retired persons	15.4	16.6	(7/)	(7/)	(7/)	(7/)	13.7	14.4	18.5	9.4
Dealers in forest land	4.3	5.5	(7/)	(7/)	1.1	2.8	(7/)	(7/)	(7/)	(7/)
Nonforest industries	1.1	5.9	1.4	15.1	(7/)	(7/)	(7/)	(7/)	(7/)	(7/)
Miscellaneous	5.8	10.3	5.4	7.5	5.0	6.8	..	..	13.3	13.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Number	Acres	Number	Acres	Number	Acres	Number	Acres	Number	Acres
Size of sample	1,387	160,873	300	(8/)	350	(8/)	306	31,507	(8/)	(8/)

1/ Excluding farm, forest industries, and unclassified ownerships.

2/ From "The Ownership of Small Private Forest-Land Holdings in 23 New England Towns" by Solon Barraclough and James C. Rettie. Northeastern Forest Experiment Station, Paper 34, Upper Darby, Pennsylvania, 1950. Limited to holdings of 10 to 12,000 acres of which only 3 were larger than 5,000 acres. The business and professional group included owners of recreational businesses, banks and other financial units, and students. Miscellaneous owners included clubs, institutions and unsettled estates.

3/ From "Private Forest Management in the Tennessee Valley." Tennessee Valley Authority, Norris, Tennessee, 1954. The business and professional group included mercantile, professional and financial owners.

4/ From "Private Forest Landownerships and Management in Central Mississippi" by Lee M. James, William P. Hoffman and Monty A. Payne. Mississippi Agricultural Experiment Station, Technical Bulletin 33, State College, Mississippi, 1951. Retired persons were included in other groups according to their former occupations. The miscellaneous group included unsettled estates, banks, churches, clubs, and unemployed workers.

5/ From "Private Forest Land Ownership and Management in the Loblolly-Shortleaf Type in Southern Arkansas, Northern Louisiana, and Central Mississippi" by H. H. Chamberlin, L. A. Sample, and Ralph W. Hayes. Louisiana Agricultural Experiment Station, Bulletin 393, Baton Rouge, Louisiana, 1945. The business and professional group included teachers, lawyers, physicians, preachers, pharmacists, salesmen, bankers, and gasoline filling station operators. The area distribution was based on acreage of pine land owned rather than on total commercial forest land.

6/ Estimate obtained by combining statistics from "Ownership and use of Forest Land in the Coast Range Pine Subregion of California" with statistics from "Ownership and Use of Forest Land in the Redwood-Douglas-fir Subregion of California," both by Adon Poli and Harold L. Baker. California Forest and Range Experiment Station, Technical Paper 2, 1953, and Technical Paper 7, 1954, Berkeley, California.

7/ No separate estimate given. If identified, these ownerships may be included in the miscellaneous group.

8/ Not published.

retirees as a separate group. Additional types of owners of varying local importance included public utilities, real estate dealers, various nonwood-using industries, estates, churches, clubs, institutions, etc. In some areas not included in the studies referred to in table 15, it is known that mining companies, timber-growing enterprises, and railroads represent important types of other private owner.

Occupations of Most Private Owners Not Connected with Forestry

Most farm and "other" private owners are engaged in occupations that are not directly connected with timber growing. There are some exceptions, including timber holding companies and certain farmers and other owners who manage their land for timber crops which they sell as stumpage or round forest products to the forest industries. Some owners classed as farmers also operate small sawmills as a supplementary farm enterprise, or find part-time employment off the farm in forest industries. Thus, in the Mississippi study cited in table 15, 7 percent of the farmers, with 26 percent of the forest land in farm ownerships, either operated small sawmills or otherwise obtained a substantial share of their income from the sale of forest products during the year of the ownership survey.

Many farm and "other" private forest landowners do not recognize timber values as a primary reason for holding forest land, according to data for a few sample areas, and to most of these owners timber growing is at best a sideline enterprise. Perhaps this is to be expected since most farm and other private owners earn their livelihood primarily in occupations outside the forest industries. Many owners have more than one reason for holding forest land. Some owners have difficulty in defining any reason at all.

Thus, in the New England study, for example, timber values were recognized as one of the primary reasons for ownership by 65 percent of the farmers and only 35 percent of the "other" private owners. Recreation, satisfaction in owning land, residence, and speculation were all cited as important reasons for forest land ownership. In this area, in the Tennessee Valley, timber production was found to be of major or primary interest to only 3 percent of all private forest landowners, including a limited number of owners of wood-using plants. Thirteen percent of the owners cited interest in timber as equal to other interests, but, for more than 80 percent of the owners, interest in timber production was no more than secondary.

Length of Tenure of Forest Land Varies Widely

The length of time land is held by a given owner has been found to vary widely. In the New England study, 23 percent of the farm and "other" private owners had held their property less than 3 years, and 41 percent less than 9 years. About one-third of all owners, with 42 percent of the acreage, had owned their land for more than 19 years. In the Tennessee Valley, only 19 percent of private forest owners had held their lands for 20 years or more.

Farmers Mostly Resident Owners: Many Other Owners Absentee

Most farmers and some "other" private forest owners reside on their forest properties, others live nearby, but many live at a considerable distance. In the New England study, for example, about half of all the private forest owners resided in the town where their forest property was located. These sample towns varied in total land area from about 5 to 70 square miles. In northwestern California, only 50 percent of the private commercial forest land was held by owners residing within the same county; 50 percent was held by owners residing outside the county, including 8 percent held by owners living outside the State.

Individual Ownerships Predominate

In the New England study, 93 percent of the private holdings (including lands of forest industries) were classed as individual ownerships; these represented 69 percent of the total forest acreage. Only 4 percent of the owners were corporations, including wood manufacturing companies, although these accounted for 28 percent of the total acreage. About 3 percent of the owners were classed as estates. In the Arkansas-Louisiana-Mississippi area, 84 percent of the farm and "other" private owners were classed as individuals, 11 percent as estates, 3 percent as partnerships, and 2 percent as corporations. In some regions such as the Lake States, there are also numerous hunting camps and other recreational properties in group ownerships, and some lands are owned by numerous owners of undivided interests.

A significant number of owners are housewives, and some owners in other occupational groups are women. In the Arkansas-Louisiana and Mississippi study, for example, women made up 18 percent of the farm and other private owners, and accounted for 12 percent of the total forest area.

With regard to age distribution, in the New England study it was found that 32 percent of the owners were more than 60 years of age, with a concentration of these older owners in the retired and housewife groups. The age class of 40 to 60 years accounted for 55 percent of the owners, and those less than 40 years of age made up only 13 percent of all owners.

Both farm and other private owners obtain possession of forest lands chiefly by purchase. In the New England study, for example, 77 percent of the farm and 74 percent of other private owners acquired their lands by purchase, 24 percent by inheritance, and 1 percent by other means, chiefly foreclosures by banks and financial institutions. Inheritance and gifts were of especial importance in the case of housewives.

"Other" private ownerships thus include a wide variety of individual and corporate owners with widely differing characteristics. A more or less typical owner might be represented, for example, by a businessman who resides in a small city near a forest property which he purchased about 12 years ago for a combination of occasional timber income and recreational use.

Productivity of Farm and "Other" Private Forests Relatively Low

About 46 percent of the recently cut area in farm and "other" private ownerships rated high in productivity, 33 percent rated medium, and 21 percent rated low (table 11). Since the ratings for all recently cut public and private lands averaged 65 percent high, 24 percent medium, and 11 percent low, it is apparent that the management of farm and other private holdings was poorer than average. In every section, farm and other private ownerships were rated below the average for all ownerships:

Owner and rating	United States (percent)	North (percent)	South (percent)	West (percent)
Farm and other private				
High productivity	46	56	38	55
Medium "	33	31	35	34
Low "	21	13	27	11
All ownerships				
High productivity	65	67	55	75
Medium "	24	26	27	20
Low "	11	7	18	5

Farm Forests Lowest in Productivity

As a class, farm forests ranked lower than "other" private forests in productivity of recently cut lands. Ratings of 41 percent high, 37 percent medium, and 22 percent low were, in fact, the lowest ratings of all the major types of owners, public or private (table 11).

There were, however, important regional differences. The highest ratings of productivity for farm forests were found in the North, for example, while the lowest ratings were in the South (table 16).

Productivity of "Other" Private Ownerships Also Relatively Low

Recently cut lands in "other" private forests were given productivity ratings somewhat higher than for farm forests, but still well below the average ratings for all public and forest industry holdings (table 11). Some 52 percent of the recently cut "other" private land was rated high productivity, in contrast to 41 percent for farm holdings and 65 percent for all holdings. The highest ratings were found in New England and California, the lowest in the West Gulf, Southeast, Central, and Middle Atlantic regions (table 16).

Table 16.--Productivity of recently cut lands in farm and other private ownerships, by section and region[1/] (Continental United States)

Section and region	Farm: Proportion of area by productivity class: High	Farm: Medium	Farm: Low	Other private: Proportion of area by productivity class: High	Other private: Medium	Other private: Low
	Percent	Percent	Percent	Percent	Percent	Percent
North:						
New England	42	39	19	74	19	7
Middle Atlantic	62	29	9	47	32	21
Lake States	59	29	12	66	25	9
Central	45	42	13	44	34	22
Plains	6	28	66	..	..	..
Total	52	35	13	59	27	14
South:						
South Atlantic	45	38	17	60	32	8
Southeast	35	34	31	46	28	26
West Gulf	18	51	31	32	34	34
Total	34	38	28	44	30	26
West:						
Pacific Northwest	46	42	12	62	27	11
California	61	33	6	79	19	2
Northern Rocky Mtn.	15	61	24	53	34	13
Southern Rocky Mtn.	56	33	11	61	27	12
Total	46	42	12	62	27	11
Total, Continental United States	41	37	22	52	28	20

1/ Recently cut lands (or operating area) in an ownership is the area of forest types in which there was some commercial cutting in the period 1947-54.

Productivity Related to Size of Holding

Productivity of farm and "other" private forests is in general related to size of holding; the relatively low ratings for these classes of ownership appear to be primarily attributable to the concentration of those lands in small and medium holdings (table 8). The "small" holdings of less than 5,000 acres show significantly lower ratings than the medium holdings, and these in turn are rated lower than the large holdings:

Size of holding (acres)	Farm ownerships			Other private ownerships		
	High	Medium	Low	High	Medium	Low
	- - - - - - - - - - Percent - - - - - - - - - -					
Small (less than 5,000)	40	38	22	40	32	28
Medium (5,000 to 50,000)	55	29	16	56	31	13
Large (over 50,000)	84	16	..	69	21	10
All holdings	41	37	22	52	28	20

The conclusion that management of farm and other private forests generally results in low productivity is supported by evidence from some of the earlier surveys previously cited. In Arkansas, Louisiana, and Mississippi, for example, it was found that "current cutting practices have so depleted the forest capital on nonindustrial lands that they are producing only about one-third of their potential capacity." A study in the Tennessee Valley showed that only 2 percent of the farm forest land in that area was well managed.

Forestry Efforts by Farm and "Other" Private Owners Limited

In general, farm and "other" private forest owners are making no substantial investments in stand improvement on forest lands other than those recently cut. In the period 1947-53, only 2 percent of these owners were supplementing commercial logging by such measures as girdling or poisoning cull trees on such lands.

The level of fire protection achieved on many farm and "other" private holdings is considerably below the level reached on public holdings and forest industry lands. Although progress under the State-Federal cooperative fire control program in extending protection to private lands has been impressive in recent years, there remains an extensive acreage where fire protection is inadequate or where there is no organized protection at all. This is particularly the case in parts of the South and in the Central States where farm and other private ownerships include the bulk of the forest acreage.

Progress by farm and other private owners also has been made in connection with tree planting. In 1953, for example, more than 350,000 acres of farm and "other" private lands were planted. This was about half the acreage planted by all public and private owners. Since most of the 52 million acres of plantable land is in farm and "other" private holdings, however, it is evident that even tree planting is relatively limited in terms of need.

Various Reasons Given for Poor Management

Relatively infrequent cutting that is characteristic for an individual farm or other private holding undoubtedly is a factor influencing the management practices of these forest land owners. Many reasons have been advanced to account for the relatively poor management of the 4-1/2 million farm and "other" private holdings. These include a lack of knowledge of forestry opportunities and procedures and lack of interest in timber production; lack of investment and operating funds for stand improvement, protection, taxes, and other carrying charges in the years when no sales are made; need for cash income with consequent pressure to liquidate timber prematurely; absentee ownership with its associated problems of supervision and risk of losing timber values; the relatively infrequent cutting that is characteristic of most small holdings; long waiting periods for income where properties are small or resources are depleted; and lack of good markets for low quality timber and for small and irregular lots of timber products.

Frequently the owner himself cannot give a cogent reason for poor management, as illustrated in the Mississippi ownership survey cited in table 15. In this survey, all private owners whose forest management was rated poor, very poor, or destructive (accounting for 75 percent of the area in the sample) were asked to give a reason for their practices. Most of these owners did not recognize the fact that their management was poor and consequently had no clear explanation for their lack of management. The explanations given included:

Reason	Percent of forest area
Lack of interest in timber production	9
Present high prices preferred to uncertain prices of future	9
Immediate need of liquidating timber for cash . . .	8
Belief that woods do not need care	7
Inability to supervise because of physical limitations or demands of more remunerative activity .	3
Long period between incomes	3
Area too far away for constant supervision	3
Miscellaneous	2
Don't know or no clear answer	56
	100

Little information is available on the relationships between intensity of forestry practices and ownership factors such as occupation, age, residence, intent of ownership, method of acquisition, or length of tenure. As previously indicated, productivity has been found to vary directly with size of holding--recently cut lands in large ownerships are significantly more productive than lands in medium-size holdings, and these in turn are more productive than recently cut lands in small holdings. There is little evidence available, however, to indicate what relationships exist, if any, between productivity and occupation or other owner characteristics.

Farm and "Other" Private Forests of Major Importance

In appraising the problems and opportunities for future timber supplies, it is evident that farm and miscellaneous private ownerships are of first importance. They represent 61 percent of all commercial forests, and because of their extent, potential productivity, and location with respect to markets should be expected to provide the major share of the Nation's future timber needs. This will require solution of difficult problems, however. Most of these ownerships are of small size, productivity of recently cut lands is relatively low, and for various reasons management efforts are limited or lacking. Increasing the productivity of farm and "other" private holdings is a major challenge for American forestry.

FEDERAL OWNERSHIPS

Federal holdings of commercial forest land total 103 million acres, or 21 percent of all commercial forest land (table 1). The noncommercial forest lands in Federal holdings aggregate about 110 million acres, or two-thirds of the 176 million acres of forest land that is unproductive for timber use or reserved for other purposes.

The national forests, administered by the Forest Service, U. S. Department of Agriculture, include 85 million acres of commercial forest land, or 17 percent of all commercial forests, and represent the largest public holdings of commercial forest land. In addition, they include about a third of the noncommercial forests, including such types as pinyon pine-juniper, chaparral, and subalpine types in the West, and unproductive muskeg and rocky areas in Coastal Alaska, as well as certain productive forest land reserved from timber use in wilderness and wild areas.

Federal lands administered by the Indian Service and Bureau of Land Management in the Department of the Interior, the Department of Defense, and various "other" Federal agencies make up about 18 million acres, or about 4 percent of the commercial forest land, plus about a third of the noncommercial forest area.

National Forests Established Largely from Public Domain

The forest reserves which were authorized by the Act of March 3, 1891, and subsequently designated as national forests, were formed chiefly from portions of the Federal public domain. By 1910, the national forest system comprised about 168 million acres of such public-domain land. Subsequently, under the Weeks Law of 1911 as amended, the Federal Government purchased certain lands for the purpose of protecting watersheds of navigable streams and for the production of timber. In 1922 and 1925, Congress also provided for additions to the national forests through exchanges of public land or timber for private forest land. Donations for national forest purposes were authorized in 1924.

By 1929, 3.7 million acres had been added to the national forests under these authorizations but, because of the elimination of other substantial areas of public domain, the total acreage of national forest land had declined to slightly less than 160 million acres.

Addition of land to the national forests was greatly accelerated during the depression years of the 1930's, as shown in the following tabulation of net areas added to or eliminated from the national forests (including limited associated lands comprised of experimental and land-utilization areas):

Period (Fiscal year)		Increase or decrease (-) (Thousand acres)
1930-34		2,841
1935-39		12,892
1940-44		3,051
1945-49		1,839
1950-54		684
1950	385	
1951	276	
1952	111	
1953	128	
1954	-216	
Total 1930-54		21,307

Much of the land added to the national forests in the depression years was by purchase and, in addition to the basic purposes of watershed protection and timber production, was designed to aid forest landowners, minimize tax delinquency, and place cutover and depleted forest lands under stable management.

Areas acquired for national forest purposes steadily declined in subsequent years, however, and in 1954 statistics show a net decrease in the area of national forests and associated lands. In recent years, land has been added to the national forests primarily through land exchanges and transfers from other Federal agencies. Exchanges and transfers to other agencies have also accounted for most of the recent eliminations from the national forests and associated lands, as shown below:

	Thousand acres
Additions, fiscal years 1950-54	
Reserved from public domain	43
Purchases	196
Exchanges - conveyed to United States	939
Transfers - from other Federal agencies	125
Donations	6
Total	+1,309
Net adjustments in acreages from new surveys, release of claims, etc.	+69
Eliminations, fiscal years 1950-54	
Returned to public domain	104
Sales, patents, and miscellaneous grants	15
Exchanges - conveyed by United States	375
Transfers - to other Federal agencies	200
Total	-694
Net change, fiscal years 1950-54	+684

Although purchases were temporarily of large importance during the depression years, purchased land in the national forests as of June 30, 1954, amounted to only 10 percent of the total national forest area. Lands acquired by exchanges of national forest land or timber, transfers from other Federal agencies, or donations constituted only 5 percent of the total:

Origin	June 30, 1929 Area (Thousand acres)	June 30, 1929 Proportion (Percent)	June 30, 1954 Area (Thousand acres)	June 30, 1954 Proportion (Percent)
Reserved public domain	156,109	97.7	154,336	85.2
Purchases	2,996	1.9	18,369	10.1
Exchanges	554	0.3	6,591	3.6
Transfers from other Federal agencies	100	0.1	1,353	0.8
Donations	2	..	409	0.3
Total	1/ 159,751	100.0	1/ 181,058	100.0

1/ Includes experimental areas and certain land-utilization areas administered by the Forest Service prior to 1954.

Lands originally acquired from the public domain thus still make up 85 percent of the national forest area. They also contain a considerably higher proportion of the timber volume in the national forests.

Purchases for national forests have been concentrated in the East, as shown in table 17, while land acquired by exchange has been located primarily in the West.

National Forest Management for Multiple Use

The basic purpose in establishing the forest reserves, according to the Administration Act of 1897, was to improve and protect the forest within the reservation, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States.

Subsequent legislation has also recognized the importance of continued use and conservation of all resources in the national forests--including water, timber, recreation, forage, wildlife, and minerals. Management of the national forests is thus geared to the concept of "multiple use" and "sustained yield" of all resources for the benefit of a wide variety of user groups.

Much land in the national forests is primarily suitable for public ownership because of the multiple values involved, including the predominance of water and the growing importance of recreation. In the western national forests are found the headwaters of all the major rivers which run through the various western States. These public forests provide the water supply for some 1,800 cities and towns, more than 15 million acres of irrigated farm lands, and thousands of power plants and industrial installations. Management of national forest lands for water production is of critical importance throughout both the West and the East to insure increasingly important supplies of usable water and to protect enormous investments in irrigation, power, and industrial developments.

The national forests also support hundreds of wood-using plants which ship lumber, plywood, and other forest products to all parts of the Nation.

Recreational resources in the national forests are enjoyed by a great variety of users who in 1954, for example, made more than 40 million visits to the national forests to enjoy the camping, fishing, hunting, and other recreational values of these public lands.

National Forests Include 37 Percent of Sawtimber Volume

The 85 million acres of commercial forest land in the national forests contain 766 billion board feet, or 37 percent of the Nation's sawtimber resources (table 6). In terms of softwoods, the national forests contain an even larger proportion--45 percent--of the present sawtimber inventory (table 7). Sawtimber stands cover well over half of the commercial forest land in the national forests, including extensive areas of old-growth timber in the western States.

Table 17.--Area of national forest land by origin, and by section and region, June 30, 1954 (United States, Coastal Alaska and Puerto Rico)

Section and region	Total area	Reserved public domain	Purchases	Exchanges	Transfers	Donations
	Acres	Acres	Acres	Acres	Acres	Acres
North:						
New England	954,806	..	946,878	3,661	..	4,267
Middle Atlantic	1,375,851	..	1,372,644	154	2,870	183
Lake States	6,712,878	1,151,298	4,514,248	1,025,019	19,028	3,285
Central States	2,260,137	13,036	2,190,433	40,283	16,329	56
Plains	206,602	196,891	657	8,960	54	40
Total	11,510,274	1,361,225	9,024,860	1,078,077	38,281	7,831
South:						
South Atlantic	3,141,786	..	3,030,800	68,720	41,330	936
Southeast	3,991,532	187,338	3,304,733	84,862	413,320	1,279
West Gulf	3,761,084	951,864	2,576,306	103,280	127,856	1,778
Total	10,894,402	1,139,202	8,911,839	256,862	582,506	3,993
West:						
Pacific Northwest	24,506,752	22,414,340	53,149	1,649,631	347,442	42,190
California	19,959,744	18,495,134	160,005	1,222,847	61,603	20,155
Northern Rocky Mtn.	46,561,757	44,954,412	40,535	1,191,198	64,478	311,134
Southern Rocky Mtn.	46,849,241	45,216,922	164,863	1,192,365	252,864	22,227
Total	137,877,494	131,080,808	418,552	5,256,041	726,387	395,706
Coastal Alaska	20,742,380	20,742,106	..	263	..	11
Puerto Rico	33,068	12,384	14,065	..	5,157	1,462
All regions	181,057,618	154,335,725	18,369,316	6,591,243	1,352,331	409,003

Attention has frequently been directed to the large volume of old-growth timber remaining in the national forests. There are a number of reasons for this. For many years the bulk of the timber harvested for lumber, pulpwood, and other forest products was cut in the East and western logging operations were centered in private timber stands which were in general more accessible and of higher quality than the timber on those portions of the public domain which the Federal Government had retained in national forests. Much of the land in the western national forests is in remote mountain areas of rough topography that was the last to be reached in the process of utilizing the Nation's old-growth timber resources. Roads suitable for timber utilization have generally been lacking, and this has meant that much national forest timber has been beyond the economic reach of logging operators.

For many years there was little demand for national forest timber and at times, particularly during the depression years of the 1930's, there was considerable pressure from the timber industries to withhold national forest timber from a market that was at the time oversupplied with privately owned timber.

In the eastern States, most of the lands acquired for national forests was of primary importance for watersheds or consisted of lands that had been cutover and heavily burned. Thus, until recently these eastern forests also offered limited opportunity for commercial timber sales.

Since the outbreak of World War II, however, demands for public timber have increased rapidly and the volume of timber cut on the national forest has been steadily rising. In 1954, the cut of national forest timber reached 5.4 billion board feet, or 2-1/2 times the cut of 2.1 billion board feet in 1940. Present national forest policies provide for bringing the cut of national forest timber up to the maximum level possible under sustained-yield management.

In the decades ahead, national forest timber will, and should, comprise a more important segment of the raw material for forest industries, in view of the volume and quality of these resources. In addition, on private timberlands in industrial holdings, the cut is often limited due to reduced growing stocks or efforts to build up a permanent timber supply. To the extent possible and within limits of sustained-yield capacity, cutting in old-growth stands in the western national forests should sustain a substantial part of the forest industries until sufficient young-growth timber matures on private lands to permit cutting in balance with productive capacity on both private and Federal lands.

National Forests of Major Importance in West

The national forests are of major importance in the western economy since they account for 52 percent of all the commercial forest land in the western States and 48 percent of the present volume of sawtimber in the West. Nearly 61 million acres, or 72 percent of the 85 million acres of commercial forest land in all of the national forests, is in the western regions (table 18). National forests in the North and South each contain about 10 million acres of commercial forest land and in Coastal Alaska about 3-1/2 million acres. In terms of sawtimber,

Table 18.--Area of commercial forest land and volume of timber in the national forests, by section and region, 1953 (United States and Coastal Alaska)

Section and region	Commercial forest land	Sawtimber	Growing stock
	Thousand acres	Million bd. ft.	Million cu. ft.
North:			
New England	822	2,310	1,038
Middle Atlantic	1,339	1,691	903
Lake States	5,895	5,652	3,199
Central and Plains	2,226	3,454	1,186
Total	10,282	13,107	6,326
South:			
South Atlantic	2,783	6,258	1,961
Southeast	3,892	8,210	2,404
West Gulf	3,697	8,748	2,379
Total	10,372	23,216	6,744
West:			
Pacific Northwest	17,109	308,907	59,694
California	8,573	178,913	32,086
Northern Rocky Mtn.	21,627	108,232	28,378
Southern Rocky Mtn.	13,351	50,476	12,732
Total	60,660	646,528	132,890
Coastal Alaska	3,445	82,524	17,139
All regions	84,759	765,375	163,099

the western national forests are of even larger importance relative to the eastern forests, with 647 billion board feet, or 85 percent, of all national forest sawtimber.

As indicated previously, areas of old-growth timber in the western national forests have not as yet been opened up for utilization and management. Access road construction and maintenance is of particular importance as a means of lessening the volumes of overmature timber lost annually to insects and other destructive agents and bringing the cut into line with sustained-yield capabilities.

Management of National Forests Becoming More Intensive

On recently cut national forest lands, productivity for future timber crops has been rated relatively good, averaging 81 percent "high" productivity, 16 percent "medium," and only 3 percent "low" (table 11).

Over the years, fire protection has been extended to all national forest lands and protection is now considered adequate in average years on 88 percent of the total area requiring protection. Areas burned have been steadily reduced and in 1952, for example, the area burned amounted to only 0.1 percent of the total area protected. Control of insects, diseases, and other pests also has been strengthened, and through such measures as aerial spraying against spruce and pine timber infested with defoliators, for example, a good beginning has been made in reducing the great losses of timber caused by epidemics of insects and diseases.

Some of the nonstocked national forest lands also have been planted, although the rate of planting is still relatively low. In 1953, for example, planting on national forests amounted to 53,000 acres, or 7 percent of the total planting by all agencies. The area of successful plantations in the national forests in 1952 totaled 1.4 million acres, or 27 percent of all acceptable plantations in the United States. About 4.6 million acres, however, are still classed as plantable.

Adjustments in National Forest Areas

The system of national forests, initiated more than 60 years ago, over the years is believed to have stood the test of time. Intermittently questions have been raised as to whether it is desirable public policy to continue a system of national forests or to dispose of all or substantial portions of these lands to individuals or to States or local governments. The continuing policy of the Executive Branch and the Congress, however, since establishment of the national forests has been one of strong support.

At the same time, with changing conditions land policies need to be adjusted to meet new economic or social situations. The boundaries of the national forests, for example, should be subject to continuing scrutiny and to adjustments which will facilitate more efficient management of both public and private land holdings. There are also situations where certain national forest lands should be offered for sale to private ownership, as for example small isolated tracts or

narrow projecting strips largely outside established boundaries, lands immediately adjacent to urban areas, or tracts suitable for townsites, when such lands are suitable for private ownership and better adapted to such purposes than to national forest uses. Exchanges of national forest land for other public or private land, and transfers of land between public agencies, also offer opportunities for bringing about more efficient administration of both national forests as well as other private or public land holdings. Subject to such adjustments, it is believed that the national forest system is sound and that its continuation and further development is desired by the American people.

The commercial timberlands in the national forests can play an increasingly important role in furnishing the Nation with continuous supplies of timber products of desirable kinds and quality, sustaining forest industries and communities, providing a steady employment base often in areas of underemployment, helping the Nation meet possible emergency needs, managing areas for demonstration of timber-growing practices, and providing leadership and stimulus to private forest land management. In recent years, the national forests have furnished about 10 percent of the Nation's total sawtimber cut. Through intensive management these public lands have the potential to provide a larger base for forest industries and an increased share of the Nation's timber needs.

Other Federal Lands Contribute to Timber Supply

The 18.4 million acres of commercial forest land under Federal administration other than in national forests represent about 4 percent of the commercial forest area (table 1). Federal agencies other than the Forest Service also administer about one-third of the noncommercial forests, including both productive lands reserved from timber use in the national parks and large areas of open woodland and other types of limited commercial value for timber.

Areas administered by the Indian Service, comprising 7 million acres of commercial forests, are included with other Federal holdings because of their Federal administration. These lands are not strictly Federal lands but are held in trust status on a temporary basis pending ultimate disposal to the Indians. Most of the Indian lands are located in the western regions and the Lake States (table 19).

Commercial forest lands administered by the Bureau of Land Management, totaling 6.3 million acres, include 2.1 million acres of valuable timber lands in the reconveyed Oregon and California and Coos Bay land grants in western Oregon, plus scattered forested areas located chiefly on the vacant, unappropriated, and unreserved public domain in the western States and Coastal Alaska. These vacant public-domain lands under certain conditions are subject to sale or other disposal to private ownership.

The 5 million acres of commercial forest land in Federal holdings, other than the national forests or lands administered by the Indian Service and the Bureau of Land Management, are largely in military reservations, game refuges, land-utilization areas, and reclamation, flood control, and power development areas. These lands are concentrated in the South but with substantial areas also located in the North.

Table 19.--Area of commercial forest land and volume of timber in Federal holdings other than national forests, by section and region, 1953 (United States and Coastal Alaska)

Section and region	Commercial forest land: Total	Commercial forest land: Indian 1/	Commercial forest land: Bur. of Land Management 1/	Commercial forest land: Other	Sawtimber	Growing stock
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Million bd. ft.	Million cu. ft.
North:						
New England	82	..	..	82	122	55
Middle Atlantic	202	..	..	202	266	155
Lake States	1,645	1,119	67	459	2,538	1,069
Central and Plains	883	369	5	509	1,334	599
Total	2,812	1,488	72	1,252	4,260	1,878
South:						
South Atlantic	701	47	..	654	1,547	470
Southeast	2,345	46	28	2,271	4,370	1,262
West Gulf	778	24	126	628	1,254	381
Total	3,824	117	154	3,553	7,171	2,113
West:						
Pacific Northwest	5,541	2,763	2,660	118	90,175	17,201
California	497	133	324	40	10,156	1,825
Northern Rocky Mtn.	2,111	822	1,206	83	7,113	1,870
Southern Rocky Mtn.	2,775	1,622	1,097	56	10,034	2,014
Total	10,924	5,340	5,287	297	117,478	22,910
Coastal Alaska	805	20	785	..	6,212	1,290
All regions	18,365	6,965	6,298	5,102	135,121	28,191

1/ Because of different definitions of commercial forest land, figures for these ownerships may vary from published figures of the public agencies concerned.

Federal lands other than the national forests support relatively heavy volumes of sawtimber, aggregating 135 billion board feet, or nearly 7 percent of the total sawtimber resource (tables 6 and 19). Approximately 56 percent of these lands supports sawtimber stands, or nearly the same proportion as on the national forests (table 5). Growing stock totals 28 billion cubic feet, or 5.4 percent of the Nation's total (tables 7 and 19). These timber volumes, as in the case of area, are largely concentrated in the western regions.

Management of Federal Lands Relatively Good

The productivity of recently cut lands in the various classes of Federal holdings other than the national forests averages about the same as on the national forests—close to 80 percent "high" productivity, and only about 3 percent "low" productivity (table 11). This is considerably better than the average ratings for all forest land holdings.

Fire protection in the United States and Coastal Alaska has been extended to all but 3 percent of the commercial and noncommercial forest lands in Indian holdings, essentially all of the forests administered by the Bureau of Land Management, and all but 7 percent of the "miscellaneous" Federal holdings. On 73 percent of the total forest area of these Federal holdings, protection is considered adequate in average years. In 1952 the area burned on Federal lands other than the national forests averaged about 0.3 percent of the area needing protection.

Tree planting on Federal holdings other than national forests covered about 24,700 acres in 1953, or 3 percent of the area planted by all agencies. Roughly a million acres of these Federal lands is considered plantable commercial forest land.

STATE AND LOCAL PUBLIC OWNERSHIPS

Commercial forest lands owned by the States comprise 19.2 million acres, or 4 percent of the total commercial forest land (tables 1 and 20). Most of these State holdings--65 percent--are located in the northern States, chiefly in Michigan, Minnesota, and Pennsylvania. About 25 percent of the State lands are found in the West, mainly in Washington, Idaho, Oregon, and Montana. About 10 percent are located in the South.

County holdings total about 7 million acres of commercial forest land, and municipal and other local public holdings about 1 million acres, or a combined total of 1.6 percent of all commercial forest land. More than 80 percent of these holdings are located in the North, chiefly in Minnesota and Wisconsin.

Present Timber Volumes Relatively Low

The commercial forests in State and local public ownerships include some well-timbered areas, particularly in the West, but on the average are not as well stocked as the forests held by other owner classes.

Table 20.--Commercial forest land and timber volume in State, county, and municipal ownerships, by section and region, 1953 (Continental United States)

Section and region	Commercial forest land		Sawtimber		Growing stock	
	State	County and municipal	State	County and municipal	State	County and municipal
	Thousand acres	Thousand acres	Million bd. ft.	Million bd. ft.	Million cu. ft.	Million cu. ft.
North:						
New England	580	257	677	332	474	204
Middle Atlantic	3,645	328	5,054	343	2,539	218
Lake States	7,747	6,152	4,368	2,661	2,953	1,972
Central and Plains	574	49	944	141	336	36
Total	12,546	6,786	11,043	3,477	6,302	2,430
South:						
South Atlantic	450	82	917	178	257	61
Southeast	1,017	535	1,329	968	469	372
West Gulf	390	9	791	19	220	5
Total	1,857	626	3,037	1,165	946	438
West:						
Pacific Northwest	2,636	505	32,853	6,908	6,579	1,340
California	186	8	4,547	195	827	34
Northern Rocky Mtn.	1,564	79	11,832	123	2,685	39
Southern Rocky Mtn.	380	43	832	40	275	17
Total	4,766	635	50,064	7,266	10,366	1,430
All regions	19,169	8,047	64,144	11,908	17,614	4,298

Thus the State-owned lands account for 3.9 percent of the commercial forest land but only 3.1 percent of the sawtimber volume (tables 1 and 6). County and municipal holdings make up 1.6 percent of the commercial forest area but only 0.6 percent of the sawtimber volume. Only 16 percent of the State and local public holdings support sawtimber stands, or far less than the average of 37 percent for all ownerships (table 5). The proportion of nonstocked areas--16 percent--is about double the proportion for all forest ownerships.

The forest lands owned by States and counties in the East were largely acquired through tax delinquency and purchase, while in the West the State lands chiefly represent the remnants of land grants received from the Federal Government. Considerable portions of the 6 million acres of noncommercial forest lands in State and local public ownerships have been reserved by States and local governments for recreational purposes, notably including the New York State Forest Preserve and scattered parks in various other States.

Management and Protection Efforts Increasing

Ratings of productivity on recently cut State lands averaged 77 percent "high," compared with 76 percent for county lands and 93 percent for municipal and other public holdings (table 11). About 5 percent of the State lands and a negligible proportion of other recently cut local public lands were rated "low" in productivity.

Fire protection is relatively good on State and local public holdings. About 76 percent of the total area of commercial and noncommercial forest land is given adequate protection in average years, and only 7 percent of the total area is without organized fire protection. Areas burned in 1952 averaged 0.8 percent of all forest lands owned by the States and local public agencies.

The tree planting record of State and local public agencies has also been relatively good and these agencies now have a total of 1.2 million acres of plantations. In 1953, about 64,000 acres of land were planted, or roughly 9 percent of the total plantations established. It is estimated that an additional 3.3 million acres are suitable for planting.

State and Other Public Holdings Important Locally

Though constituting a relatively small part of the total commercial forest land, State and local public holdings have an important place in the future timber-supply picture for a number of the States. In addition, State agencies play a major role in forestry programs on private lands throughout the country.

As in the case of Federal lands, multiple uses--for timber, recreation, game, and water--are important on a large part of the State and local public forest lands. Many of these holdings, particularly in the East, have been placed under permanent administration in organized State or county forests, although other areas are not specifically managed or are available for sale to private owners. Considerable areas of scattered tracts, especially in the West, are administered by State

Land Boards. In some cases, State and county lands are too scattered for efficient management and there is need to consolidate certain holdings for more effective management.

KEY PROBLEMS OF OWNERSHIP

Review of forestry progress clearly indicates that the greatest advances in protection and management of commercial forest land and timber resources have been made on the holdings of the forest industries and public agencies. Together these ownerships represent 39 percent of all commercial forest lands. The poorest forest conditions and the most difficult problems of ownership are found on the small holdings of farmers and "other" private owners, many of whom hold their lands primarily for purposes other than timber growing. In the aggregate, these farm and "other" private ownerships include 61 percent of the Nation's commercial forests. For many years, they have supplied a large proportion of the logs, pulpwood, and other raw material used by forest industries.

If prospective timber requirements are to be met, it is evident that most private and public forest holdings must yield substantially more timber than is presently grown or cut from these lands. There are various reasons for the lack of management on most forest properties, some of which are technical, some economic, and some psychological in nature.

In recognition of the complexity of forestry problems, a variety of programs have been developed in the United States aimed at improving the protection and management of both private and public forest lands. In developing new or more adequate programs to meet current problems and changing conditions in the future, facts of forest ownership will be of key importance. Landowners' decisions are influenced by various factors, most of which are of undetermined importance. Difficult policy questions relating to ownership are necessarily involved in appraising the need for program modifications, some of which represent broad issues which extend far beyond the limits of forestry.

As an illustration of these problems of ownership, the question is frequently raised as to what is a desirable balance between public and private ownership, and between various classes of private and public holdings. Part of this question involves the extent to which large forest industries should further expand their holdings of commercial forest land through purchase and consolidation of small private ownerships.

In connection with programs of assistance to landowners, another important question relates to the possible limitation of available funds and manpower to assist selected classes of owners, such as owners of the better forest lands, particular types of owner, or owners of the larger holdings who in general appear to be more responsive to forestry programs than owners of small holdings. By concentrating programs on owners of more than 30 acres of commercial forest land, for example, half of all farm and miscellaneous "other" private holdings might be eliminated with a loss of coverage of only 6 percent of the total commercial forest land area.

Another continuing question relates to the desirable intensity of management of public forests and the balance that should be maintained between timber and other alternative uses of public lands. As a final illustration, the question is often posed as to what degree of responsibility forest industries should assume for improving the cutting practices of woods operators cutting on the lands of farmers and miscellaneous "other" private owners.

These are a few of the issues pertaining to ownership that must be appraised, tentatively answered, and continuously studied in formulating and executing programs for American forestry.

Regions and Sections used in the Timber Resource Review

TIMBER RESOURCE REVIEW

CHAPTER IV
FACTORS AFFECTING FUTURE SUPPLY AND QUALITY OF DOMESTIC TIMBER

E. FINANCIAL AND ECONOMIC FACTORS
F. FORESTRY ASSISTANCE PROGRAMS

(Preliminary Review Draft Subject To Revision)

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

TIMBER RESOURCE REVIEW

CHAPTER IV. F A C T O R S A F F E C T I N G F U T U R E S U P P L Y A N D Q U A L I T Y O F D O M E S T I C T I M B E R

E. FINANCIAL AND ECONOMIC FACTORS

(Preliminary review draft subject to revision)

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September, 1955

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FINANCIAL AND ECONOMIC FACTORS

INTRODUCTION

In addition to the factors discussed previously, economic and financial considerations bear on the future supply of timber. Whether prosperity or depression prevails in the future, the economic climate will be a major factor influencing the timber resource. As already indicated, this report envisions an expanding economy -- rapid population growth, moderate outlays for national security, a favorable price relationship for timber products, and a gross national product in the year 2000 at least double the 1950 level. Within this framework, the demand for timber is expected to expand substantially. If this demand is to be met, increased expenditures will be necessary for forest protection, timber-stand improvement, planting and other cultural practices. Forestry on private land will become more and more a business venture and the demand for publicly-owned timber is likely to increase.

As in any business enterprise, financial factors will strongly affect the future of forestry. Cost factors such as interest and wage rates, anticipated profits and risk, and the availability of capital in some degree influence the decisions of all the several million owners of forest land.

The forest industries in this country represent large investments in harvesting, manufacturing, and marketing facilities and nearly 400 million acres of forest land are in private ownership. To operate these forest holdings and industrial facilities involves not only the ever-increasing use of capital but also risk of loss from fire, pests, windstorm and other hazards. In forestry the long-term nature of the timber resource creates tax and credit problems which have not yet been fully met and which call for attention. Closely related to credit is insurance, and in fact without insurance it is doubtful if some credit problems can be solved. All three -- taxes, credit, and insurance -- are financial considerations which can either be deterrents or incentives to private forestry and the future supply of timber.

TAXATION

Three types of taxes have a strong bearing on forestry: property taxes, income taxes, and death taxes. Each has special aspects and problems.

Property Taxes

Frequently cited as a main reason for accelerated cutting of timber to avoid accumulation of fixed charges, the property tax has been objected to because of the heavy financial burden, and because of the requirement for annual payment where there is no annual income.

In recent years a combination of factors has reduced to some extent the importance of the property tax as a forestry deterrent and under the economic assumptions mentioned previously this trend may continue.

First, as a source of revenue, property taxes have continued to decline in relative importance. Fifty years ago half of all State revenues and nearly three-quarters of county revenues came from the property tax. Today less than 2 percent of State and about half of local revenues are derived from this source.

Second, progress in the reorganization of local government has helped to hold down the tax burden. The total number of governmental units in the United States declined 25 percent from 1942 to 1952. This reduction was mostly in school districts and townships.

Third, higher Federal income tax rates of recent years have had the indirect result of reducing the effective burden of the property tax and other carrying charges as such costs are deductible from the taxpayer's gross income. The local tax collector is merely receiving part of what the Federal tax collector would otherwise receive.

Finally, in recent years inflationary forces have worked to the temporary advantage of the property owner since tax rates and assessments tend to lag behind the upward movement of the general price level. Nevertheless annual property taxes on deferred yield timber properties still constitute a significant factor tending to discourage investment in forests and to foster premature cutting.

Inequitable distribution of the property tax among individual property owners is frequently a problem since there is a tendency in forest land assessment for low value properties to be over-assessed and for high value properties to be under-assessed. Improvement in the assessment of timber and forest land has lagged behind advances in the practice of assessing other and generally more productive classes of property. But there has been some progress in understanding the elements of timber and forest land appraisal, in the preparation of comprehensive assessment manuals, and in training assessors. The substantial progress made by a few States, however, has not spread to others where assessors are often underpaid, under-staffed, and without proper guides for appraisal work. Improved assessment, based upon aerial photography and other modern methods, is today a basic need. Only by accurate appraisal and assessment can the tax burden be equitably distributed among property owners.

The inherent disadvantage of the annual property tax in respect to deferred yield forests may be minimized by managing a forest so that income is realized annually or at short intervals or the tax itself may be modified. Development in the first direction is taking place and eventually may do much to make the annual property tax less burdensome. Modification of the property tax has taken various forms. In earlier years emphasis was on exemptions, rebates, and bounties. Much attention also has been devoted to a yield tax under which timber is exempt from annual taxation and instead is taxed on the gross value of the timber when cut -- with annual taxes levied only on the land. Fourteen States now have yield tax laws but in 11 of these classification of forest land is optional and the yield tax is used very little. In the remaining three States the yield tax is mandatory, but even here its operation has not been without difficulty. Somewhat similar to yield taxes are severance taxes which are in effect in six States.

Even though the property tax is not at present the deterrent that it has been or has been thought to be, continued emphasis on improved assessment is needed so that the tax burden may be equitably distributed. Also, efforts should be continued to devise modifications of the property tax so as to better meet the needs of both forest land owners and government.

Income Taxes

The Federal Government and many States levy net income taxes, but State income tax rates are relatively low, for the most part not exceeding 5 percent. Changes in income tax laws have been made in recent years and others have been proposed that affect forestry operations. The more important of these have been the timber capital gains amendment of 1943 (often referred to as Section 117-k[1/]), provision for accelerated amortization of industrial facilities, and proposals that planting costs be treated as deductible expenses.

The 1943 timber capital gains amendment to the Internal Revenue Code in effect permits the taxpayer who cuts timber to treat as a capital gain or loss the difference between the cost of the timber cut and its fair market value as stumpage. The difference between the fair market value of stumpage and proceeds from sale of resulting products (less processing costs) must be treated as ordinary income. Capital gains possess tax advantages not enjoyed by ordinary income. In the case of individual taxpayers capital gains may be taxed at one-half the rate applying to ordinary income; and in the case of individual and corporate taxpayers, the tax on capital gains is subject to a ceiling of 25 percent, or in some cases 26 percent, of such gain irrespective of the taxpayers bracket.

The 1943 amendment was justified primarily on two grounds. First, it would remove inequity by making available to taxpayers who cut timber the benefits of capital gains treatment already enjoyed by taxpayers who sold timber outright. Second, it would act as an incentive to the practice of forestry by making timber growing more attractive and thus stabilizing the ownership of forest properties. While timber owners have received substantial tax advantages from the 1943 amendment, no information is available regarding either the extent to which tax receipts have been affected or the extent of improvements in forest practices that have resulted.

In order to meet the industrial needs of a wartime emergency, a Federal tax amortization program was initiated at the outbreak of the Korean War. This provided for tax write-off over a 5-year period of such part of the investment in new industrial facilities as was certified as essential to the national defense during the emergency. This proportion varied for the most part from 40 to 60 percent of total new plant investment. In administering this program as applied to forest industries availability of current and prospective supplies of timber was regarded as an important consideration in order to encourage new processing facilities where there was an adequate raw material supply.

1/ Under the Internal Revenue Code of 1954 this is now Section 631.

Under this tax program applications were filed for 365 plant expansions or new plants to produce pulp and paper, veneer and plywood, and other forest products. These proposed expansions represented plant investments of $1.6 billion and a possible additional drain on the timber resource of nearly 13 million cords. Applicants were required to indicate specific intentions and plans for wood procurement including use of hardwoods, for example, in areas of deficient softwood supply. It was expected that individual companies would adhere to such indicated conditions for at least the period of accelerated tax amortization.

No over-all evaluation of the accomplishments of this program has been attempted. It is evident that rapid expansion of plant capacity was encouraged. Attention was directed to the importance of timber supply and the need in many cases for expanded forestry efforts to provide adequate raw materials. Some construction of new facilities in timber deficit areas was avoided. Greater use of the abundant hardwood supply for pulp and paper was encouraged. On the other hand, and particularly where specific intentions for wood procurement were not adhered to, the accelerated expansion increased the over-cutting of preferred species in certain areas and accentuated the need for more aggressive forestry programs.

Deduction of planting costs from gross income as an operating expense for the year in which incurred has frequently been urged as an incentive to reforestation. At the present time planting costs must be capitalized, that is treated as an investment to be deducted from the selling price at time of harvest in order to determine the gain or loss. While the proposed change would almost certainly lead to some increased planting, its extent is difficult to estimate. Current tax revenues would be reduced although the tax loss would tend to be offset in the future as the planted tree reached maturity and produced taxable income. An objection from the standpoint of the timber grower to treating planting costs as deductible expenses is that this might jeopardize the capital gains treatment that he now enjoys. Thus, if timber were treated as an ordinary asset at time of planting (as by "expensing" planting costs), it might lose its preferred position as a capital asset at time of harvest.

Death Taxes

The Federal estate tax is payable in full 15 months after a decedent's death. Inheritance and estate taxes imposed by the States vary as to time of payment but the requirement is usually 12 to 18 months after death. Because of this relatively short time it may be necessary to sell immature timber to secure the necessary funds, and death taxes may thereby become a deterrent to forestry. Undue hardship on the estate may be the basis for extending the period of payment for an extended period of years with interest usually amounting to 4 percent or more. Such hardship though is strictly defined, and authority to extend the period of payment is used sparingly.

Since corporate holdings are not subject to death taxes, and since the smaller estates may be entirely or partially exempt, the problem would arise chiefly in the case of the larger individual estates. In this

connection, although the problem does not appear to be acute, the approach used in Great Britain is of interest as one method of alleviating such hardship as may occur. There, death taxes are levied on net timber receipts and need not be paid until the timber is harvested. Expenses taken into account in calculating net receipts include logging and selling costs and in some cases expenses of replanting and management. If the new owner dies before the earlier death tax has been discharged, the unpaid balance is canceled and the timber is again valued and a new death tax calculated.

Contributions in lieu of taxes

Because of the large Federal and State holdings in some areas, increasing attention is being given to the contributions in lieu of taxes made to local governments. Various provisions for such payments have been enacted both by the Federal Government and by many of the States in years past. Some of these provisions call for a sharing of revenues derived from public lands while others provide for fixed payments per acre or for payments based upon property value, in some cases being calculated as an exact tax equivalent.

On the national forests revenue sharing payments are of chief importance. Twenty-five percent of gross receipts is paid annually to the counties in which a national forest is situated in proportion to the area of national forest land in each county. Payments to local governments from national forest receipts have increased sharply in recent years rising from $1.1 million in 1938 to $16.4 million in 1954. In this period the average payment from the "25 percent fund" has risen from less than 1 cent to 10 cents per acre of national forest land. Special contributions provisions apply to certain national forest lands in Arizona, New Mexico, and Minnesota and to Bankhead-Jones Title III (Land Utilization Project) lands.

The question frequently arises as to how contributions to local governments on account of national forest lands compare with the taxes levied on similar land in private ownership. In order to gain a clearer understanding concerning this, the Forest Service undertook a sampling study for the year 1952. The study was conducted with a three-fold purpose: (1) to estimate amounts that might be payable on national forest lands and timber if such amounts were equivalent to taxes on similar property in private ownership; such amounts are referred to as "estimated taxes", (2) to estimate the value of contributions in kind such as certain expenditures for roads and fire control that States or counties would be able or willing to spend in the absence of Federal outlays; and (3) to compare estimated taxes with 25 percent fund payments and contributions in kind. Detailed studies were made for 135 sample counties from 652 counties containing national forest lands. National forest lands in these counties comprise 40 percent of the total national forest acreage in the continental United States.

Results of the study[2] were as follows:

	Dollars (millions)	Cents per acre	Percent
Estimated tax, calendar year 1952	29.7	19	..
25-percent fund payments, fiscal year 1952 - - - - - - - - - - - -	17.4	11	..
Contributions in kind, fiscal years 1950-1952, average annual	38.8	24	..
Estimated tax as percent of 25-percent fund payments - - -	..	..	171
Estimated tax as percent of combined 25-percent fund payments and contributions in kind	..	..	53

As shown in the table, "estimated taxes" on national forest land and timber in 1952 would have amounted to $29.7 million or 19 cents per acre of national forest land. Payments from the "25-percent fund" in the same year totaled $17.4 million or 11 cents per acre. Contributions in kind for the years 1950-1952 averaged $38.8 million, or 24 cents per acre. Thus while "estimated taxes" were 19 cents per acre, the payments from the "25-percent fund" plus "contributions in kind" totaled 35 cents, or almost double the prevailing tax level.

In estimating contributions in kind, the test applied was whether the particular expenditure was such that the State or local government would have been financially able and willing to spend equivalent funds during the period in question had national forest expenditures not been available. Over the country as a whole the fire control contribution claimed was roughly 70 percent of the actual Federal expenditures for fire control on the national forests. Contributions claimed for construction and maintenance of roads, trails, and structures amounted to roughly 45 percent of the total national forest expenditures for such purposes. Contributions claimed also included expenditures for Forest Highways under the Federal Highway Act of 1921 as amended. These funds accrue to the States only by reason of the existence of the national forest system.

In addition to the countrywide sampling study for the year 1952, an analysis of trends in the relation of shared revenues and estimated taxes was made for the fifteen years--1938-52. This study was undertaken on three national forests. The first was representative of Western old growth public domain forests not yet fully served by access roads, the second was representative of Northern hardwood forests subject to relatively slow recovery, and the third was representative of cutover Southern pine forests subject to relatively rapid recovery.

2/See also National Forest Contributions to Local Governments Land Economics volume 31, number 3, August, 1955.

On all three forests a marked change was found in the relation of contributions to estimated taxes. While both taxes and revenue sharing payments have increased, the latter have increased much more rapidly. Dividing the fifteen years into three periods of five years each, it was found that on the Western old growth and Northern hardwood cutover forests estimated taxes averaged roughly twelve times revenue sharing payments in the first 5-year period but less than twice such payments in the third period. On the Southern pine forest the change was even more striking. Here estimated taxes averaged twenty-eight times revenue sharing payments over the first period but only six-tenths of such payments over the third period. Results are summarized in the tabulation that follows.

Years	Estimated taxes as multiple of 25-percent fund payments		
	Old growth public domain forest	Northern hardwood cutover forest	Southern pine cutover forest
1938-1942	12.8	11.9	28.3
1943-1947	5.6	3.6	1.1
1948-1952	1.4	1.8	0.6

When contributions in kind, such as those for fire control and roads are added to 25-percent fund payments, the combined total in most cases much exceeded estimated taxes. As forest productivity continues to approach full sustained yield capacity, moreover, 25-percent fund payments may be expected to increase still further.

In view of present relationships and trends, there appears to be little need for basic change in the existing revenue-sharing procedure for national forests. While annual payment of an equitable percentage of the fair value of the land has been proposed in the past as a substitute for 25-percent fund payments, the cost of periodic valuations and the disruption of existing reimbursement patterns would make such a change difficult both for the Federal government and for local governments.

Changes have also been proposed in the existing method of pooling receipts by national forests and distributing revenue sharing payments in proportion to the area of national forest land in each county. On the one hand return of receipts to county of origin has been suggested as more equitable. On the other hand pooling of receipts by State with distribution among counties in proportion to area or timber value has been suggested as a means of reducing fluctuations in payments from year to year. There appears to be distinct advantage, however, in retaining the present compromise system. While perhaps not as equitable as returning receipts to county of origin, it is more equitable than pooling receipts for the State as a whole. At the same time while less stable from the standpoint of the recipient county than pooling receipts for an entire State, it is more stable than returning receipts to county of origin.

There are a number of relatively minor changes in the present system that might improve its operation. Such changes could well include use

of a 5-year moving average in order to secure greater stability of annual payments, inclusion in gross receipts of the value of national forest timber granted in exchange for land, establishment of a temporary floor under revenue-sharing payments on newly acquired lands, and elimination of the restriction that 25-percent fund payments be used by the counties for roads and schools.

CREDIT

If timber is to be grown in adequate supply for future needs, and if the quality of forest products is to be improved, timber growers must have access to adequate risk capital and credit. Many forest land owners have only limited financial resources and are forced by economic pressures to liquidate timber prematurely and to forgo the increased incomes that might be achieved through timber management or simply through waiting.

Sources of forest credit in the United States, while increasing slowly, are still limited. This has been due to a number of factors. First, there is the great length of the productive period, 50-60 years or more often being required to mature a timber crop. Again the risk factor has loomed large with lack of adequate insurance against fire and other hazards. Finally there is the fact that forest enterprise has only recently been shifting to a sustained yield basis with increased capital and credit needs.

The need for forest credit may arise in different ways, call for loans with varying maturity dates, involve different degrees of risk, and be supported by liens on different kinds of property. To meet these needs may require the establishment of lending institutions specializing in forestry loans.

Long-term investment credit for terms in excess of 10 years is sometimes needed to finance the purchase of forest land, to permit blocking up of existing holdings, and to enable an integrated owner-processor to operate at a more efficient level. Investment credit may also be needed to finance planting and cultural measures or to construct or modernize a processing plant.

The greatest need of the timber grower is for long-term investment credit at low interest rates. It is this type of credit that has been supplied least adequately. Several of the Federal land banks are making forest loans to individuals for terms up to 40 years, and in recent years a number of life insurance companies have been making forest loans for terms up to 30 years. Outstanding timber loans by Federal land banks now exceed $6 million and those by life insurance companies are also understood to aggregate several million dollars.

The soil and water conservation loan program authorized by the 83rd Congress in 1954[3/] may further help to meet forest credit needs. Under

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3/ Public Law 597 - 83rd Congress approved August 17, 1954.

this law broad powers are given to the Secretary of Agriculture for both direct and insured farm land improvement loans including those for sustained yield afforestation and reforestation and related erosion preventive measures. The extent to which long-term forest credit can be supplied through commercial channels, or whether State or Federal assistance will also be needed remains an unanswered question requiring further study.

Intermediate credit, for terms from 2 to 10 years, may be needed to pay taxes and other carrying charges or to finance the purchase of tractors, loaders, trucks, and other logging or mill equipment that will be self-liquidating within the period in question. Since amendment of the banking laws by the 83rd Congress in 1953[4], there has been additional provision for intermediate credit. This amendment authorized national banks to make loans for terms up to 10 years secured by forest tracts "which are properly managed in all respects". The Treasury Department has interpreted proper forest management to mean the application of suitable and economically sound forestry principles relating to protection, utilization, and reproduction. A number of forest loans have already been made by national banks under the new law. In certain areas similar loans are being made by State-chartered banks.

Short-term commercial credit for terms up to 2 years for payrolls, purchase of supplies, or working capital etc. has usually been available to established operators through commercial lending institutions and probably is no more difficult for the timber operator to obtain than for other manufacturing enterprises.

INSURANCE

Timber losses from fire and other hazards not only reduce the available supply but also discourage capital investments in forestry. The possibility of loss also leads to the cutting of immature timber and makes forest credit hard to get. Such adverse influences call for greater emphasis on forest insurance.

It is the primary function of insurance to eliminate risk or uncertainty by distributing the economic impact of loss among many property owners. In addition, experience has shown that insurance leads to increased emphasis upon loss prevention and consequently to reduction of the loss itself. The need for insurance is not equally strong with all timber owners. Some holdings are so extensive, so broken up, and so well protected that there is a sound actuarial basis for owner assumption of risk, or self-insurance. For the majority of ownerships, though, the uncertainty of loss is a very real deterrent to intensive forest management. This is especially true of the smaller absentee-owned forest tracts which are intermingled with other ownerships.

There is now sufficient knowledge of forest fire occurrence and damage to serve as an actuarial basis for fire insurance. A few fire insurance companies have been underwriting a slowly increasing volume of forest-fire insurance but the total remains small. Insurance against hazards other than fire is practically non-existent.

4/ Public Law 285 - 83rd Congress approved August 15, 1953.

Legislation adopted in 1944 authorizes the Federal Crop Insurance Corporation to expand its program by insuring agricultural commodities including standing timber upon a trial basis. Thus far, however, no forest insurance has been written by this agency. For such trial programs insurance is limited to 3 years and to 20 representative counties. The insurance that may be provided is virtually "all-risk" in character, for the law authorizes coverage against "drought, flood, hail, wind, frost, winter-kill, lightning, fire, excessive rain, snow, wildlife, hurricane, tornado, insect infestation, plant disease, and...other unavoidable causes".

Continued progress in forest insurance is likely to come from one or more of three directions: (a) increased interest on the part of commercial insurance underwriters, (b) formation of a mutual insurance company by timberland owners, or (c) State or Federal initiative in providing direct insurance or re-insurance, possibly in conjunction with a forest credit program. Although the first alternative is slowly making headway, the second and third deserve renewed consideration.

CONCLUSION

The financial factors of taxation, credit and insurance are rarely neutral in their effect upon forest enterprise. As pointed out earlier, such factors are likely to serve either as deterrents or as incentives to the practice of forestry in maintaining and increasing our future timber supply.

As the shift to sustained yield forest management gains momentum, continuing adjustments of a financial character are needed. But this process takes place unevenly. In the tax field, income taxes cannot for the most part be regarded as forestry deterrents. State income tax rates are low and Federal income tax provisions relating to capital gains, are generous. While further adjustments will doubtless be made, none of an adverse character are anticipated. Death taxes likewise do not appear to impose undue hardship in the great majority of cases.

The situation with respect to local property taxes is less favorable. Substantial improvements in certain States cannot conceal the fact that over the country as a whole the administration of the property tax as it applies to forest lands leaves much to be desired. Continued efforts in improving the administration of the tax and in devising modifications suited to deferred income properties are clearly needed.

Public lands on which revenue sharing payments or other forms of contributions in lieu of taxes are being made do not appear in general to constitute tax burdens although improvements in some respects are desirable. The importance of suitable credit and insurance facilities is receiving increased recognition on the part of both public and private agencies. Continued efforts in these fields give promise of significant gains in the years immediately ahead.

There appears to be little likelihood that financial factors affecting forestry will become more of a deterrent in future years and there are

indications that they will become less. This holds real encouragement especially for the smaller forest owners who do not have the resources of the larger enterprises and whose decisions are strongly influenced and at times controlled by financial considerations.

TIMBER RESOURCE REVIEW

CHAPTER IV. FACTORS AFFECTING FUTURE SUPPLY AND QUALITY OF DOMESTIC TIMBER

F. <u>FORESTRY ASSISTANCE PROGRAMS</u>

(Preliminary review draft subject to revision)

By:

M. B. Dickerman

September, 1955

Contents

FORESTRY ASSISTANCE PROGRAMS

INTRODUCTION

Forestry assistance programs have the general objective of improving forestry on private holdings through the use of educational techniques, by giving direct on-the-ground advice, and through other forms of assistance to timberland owners. Numerous forestry assistance programs have been sponsored by various public agencies and private organizations. Following World War II the number of organizations and the diversity of programs increased noticeably. Assistance efforts have been primarily, although not exclusively, directed toward improving forestry on the more than 4 million small, private forest holdings, especially farm woodlots.

In a broad sense, forestry assistance programs now include six major activities: education, technical guidance, tree distribution, conservation payments, protection, and research. Both public and private programs, such as those of the American Tree Farm System and the Agricultural Extension Service, may and frequently do include more than one type of assistance. Likewise, the application of any one type of assistance varies considerably from one organization to another. Assistance by education involves such activities as dissemination of technical information through various types of publications, holding group meetings, using demonstration areas, and other education techniques for reaching a broad cross section of the American public. Usually education stops short of servicing individuals. Technical guidance refers to giving on-the-ground advice to individual landowners and timber processors. Tree distribution provides planting stock at a minimum cost, and conservation payments provide direct financial help to individuals for carrying out specific approved forestry practices. Protection activities include forest fire and pest control. Forest research develops technical information on how to manage the timber resource for maximum productivity.

PUBLIC COOPERATIVE PROGRAMS

Forestry assistance programs of public agencies are characterized by Federal-State cooperation and have been carried on in one form or another for more than half a century. Back in 1891 the old Bureau of Forestry in the Department of Agriculture distributed tree seeds free as a means of encouraging planting. Some years later the Forest Service was assisting timber owners in preparing management plans, and through the Weeks Law of 1911, Federal assistance to the States in fire protection was authorized. In 1914, two States, Michigan and New York, were including forestry in their agricultural extension programs.

Beginning in the twenties and for some years thereafter, the present pattern of Federal-State cooperative programs was accelerated by Congressional action. The Clarke-McNary Law of 1924 and subsequent amendments authorized the Secretary of Agriculture to enter into cooperative agreements with States for fire protection on State and private land, for the production and distribution of forest planting stock, and for work in farm forestry extension. Then in 1928 the McSweeney-McNary

Law authorized the establishment of the present system of Federal forest experiment stations as a service for all forest owners. Further emphasis was given to research by the Research and Marketing Act of 1946. Federal and State assistance to private forest owners was broadened and clarified through the Norris-Doxey Cooperative Farm Forestry Act of 1937 and the Cooperative Forest Management Act of 1950. To provide greater protection against forest insects and disease the Forest Pest Control Act was passed in 1947.

Through these laws as amended, a number of Federal-State assistance programs are now in effect. The scope and some of the major accomplishments of these public programs are indicated in the following brief summaries.

Fire Prevention and Suppression

Federal-State cooperation in fire prevention and suppression is not only one of the oldest public forestry assistance programs but is also the largest in terms of funds expended. Back in 1911, with the passage of the Weeks Law, the Federal Government began to share in the cost of fire protection on State and private forest lands. As protection needs on these lands developed, cooperation between Federal, State, and private owners became a standard pattern. In 1953 the cooperative fire control program provided protection for 374 million acres of State and private forest and watershed lands. However, some 53 million acres are still without any organized protection.

Credit for the present system of forest fire control on State and private lands goes largely to the States. Through their efforts an efficient and effective fire control program has developed in most States. Of the 38 million dollars expended in 1953 for cooperative fire control under the Clarke-McNary Act, the States and their subdivisions paid 71 percent of the cost, the Federal Government 24 percent, and private owners 5 percent. Federal assistance to the States includes--in addition to financial contributions--some technical aid and guidance in the development and use of fire control equipment, in fire action planning, and in training of personnel.

The Cooperative Forest Fire Prevention campaign is especially noteworthy as an example of Federal-State cooperation. Active since 1942, it uses the free public service resources of the various national advertising channels. The National Advertising Council, by providing over 4 million dollars of advertising space and facilities annually, is actively furthering the fire prevention campaign. Prominent in this work is the character Smokey Bear, serving as a national symbol of forest fire prevention.

Evidence of the effectiveness of Federal-State cooperation in forest fire prevention and suppression is shown by the fact that the acreage burned in 1953 was less than 1 percent of the area where there is organized protection, in contrast to more than 13 percent of the area where there is no organized protection. Examples of recent progress under Federal-State cooperation are the initiation of interstate forest fire prevention compacts in the Northeast, the South-Central States,

and the Southeast; the enactment of stronger State fire control legislation; the establishment of stations for rating fire danger; and the use of aircraft in fire control.

Forest Management Assistance

For many years both State and Federal agencies have cooperated in giving limited technical help in forest management to farmers and other timberland owners. Recognizing that this work was gaining in importance and in the amount of time required, the Federal-State program was broadened and clarified in 1950 by the Cooperative Forest Management Act. Consequently, there is now a cooperative program through which both farm and non-farm owners of forest tracts are advised and assisted in the management of forest holdings and in the marketing of forest products.

In providing such technical assistance the States employ technically trained foresters who are commonly known as service or farm foresters. In 1953, 262 of these service foresters were working in 38 States. Accomplishments have been increasing slowly, and in 1953 over 32,000 woodland owners with holdings of about 3 million acres were given technical assistance. Under the service foresters' guidance, over one-half billion board feet of sawlogs and other forest products were harvested. In addition, a large number of owners were referred to consulting foresters.

Approximately two-thirds of the cost of this assistance program is paid by States and one-third by the Federal Government. Total expenditures in 1953 were about 1.8 million dollars.

Tree Distribution

To encourage and speed up planting of cutover lands and understocked forest stands, a Federal-State cooperative tree distribution program has beem in effect since 1924. In this program the individual States distribute trees for forest and shelterbelt planting from State nurseries at a nominal cost, or free under certain conditions. Most of the planting stock is grown in State-operated nurseries, although a few States purchase their stock from commercial or Federal nurseries. Landowners desiring to obtain trees deal directly with State agencies, and participation in the program by the Federal Government is chiefly in furnishing technical information and some of the funds.

Forty-three States were participating in this cooperative tree distribution in 1953. Under the Federal-State program 435 million trees were distributed to private landowners in 1953—enough trees to plant 435,000 acres. In this same year the total planting on all private land was about 574,000 acres so the cooperative tree distribution program had a part in at least two-thirds of the area planted in that year.

Approximately 4 million dollars were expended in 1953 on the growing and distributing of trees under this cooperative program. Fifty-two percent of the cost was paid by States, 10 percent by the Federal

Government, and 38 percent by individuals. These individuals also paid for the cost of planting except when the Agricultural Conservation Program and other programs made partial reimbursement.

Extension Forestry

One of the key forestry education programs for 40 years has been that of the Extension Service. The general objectives have been to stimulate the interest of farmers in forestry and to demonstrate and encourage desirable forestry practices on farm woodlands. Carried out by State extension service units in the land-grant colleges and given financial support by the Federal Government, extension forestry is active in 45 States.

One of the newest ideas of the extension program is the so-called farm and home unit approach which emphasizes coordinated planning of all farm and home activities for better farm living. Through the county agents and with the aid and service of extension foresters, farmers will get more detailed information on, and have more interest in, desirable farm practices. Thus, along with other farm practices, woodland management practices, timber utilization and marketing, and tree planting will be integrated as part of the farm operating unit.

In 1953 about 90 extension foresters reported work in 2,709 counties. Assistance was given to 175,000 farmers in planting trees and to 76,000 farmers in timber stand improvement work. Other activities included information on timber harvesting, estimating, appraising, and marketing. Considerable time was also spent in working with 4-H Club members.

Total expenditures for extension forestry in 1953 were about $600,000. Of this total, 57 percent was paid by the States and 43 percent by the Federal Government.

Agricultural Conservation Program

To help bring about improved soil-and water-conserving practices, a Federal-private program involving cost sharing with individual farmers was initiated in the midthirties. Although constituting a part of this broad program, forestry has always been a minor item in it. In the last 10 years, forestry has accounted for less than 1 percent of the conservation payments in the Agricultural Conservation Program. Under this program, cash payments are made to farmers for certain forestry practices, chiefly tree planting, timber stand improvement and maintaining shelterbelts. Technical guidance for this work comes from farm and extension foresters when such technicians are available. Usually the farmer does his own work, and the Federal cost-sharing payment covers only a part of the cost incurred.

Under the Agricultural Conservation Program, forestry accomplishments have steadily gone up. In 1953, payments to farmers, for some 34,000 forestry projects, totaled about $1,000,000. Tree planting, the principal activity, covered over 80,000 acres in that year.

In addition, payments aggregating over $400,000 were made in 1953 to 2,625 naval stores operators in five Southern States under the Naval Stores Conservation Program.

Forest Insect and Disease Control

Reducing losses from forest insects and disease calls for leadership and participation in action programs by public agencies, both Federal and State. The groundwork for Federal and State action was laid with passage of the Forest Pest Control Act in 1947. The primary purpose of this Act was to provide for periodic surveys to detect and appraise infestations and for control programs when necessary. In order to obtain the fullest coordination and advice in developing pest control programs a national advisory committee was established in 1952 by the Secretary of Agriculture.

Federal action to reduce forest pest losses was long overdue when compared to the fire control program initiated 40 years ago. Although the present program is substantially less than authorized, there has been notable progress in the few years since the Forest Pest Control Act was passed. In this short period some States have enacted legislation facilitating cooperation between Federal, State, and private agencies and making it possible for public agencies to control forest pests on private land when this is in the public interest. In 1952, 31 States had some type of legislation applicable to forest pest control.

Through the interest stimulated by the Forest Pest Control Act, policies and programs for regional and State survey and control programs have been emerging, and numerous activities are now under way. In some States as epidemics have appeared, private, State and Federal groups have joined forces and developed well-coordinated plans for both detection surveys and control work. In 1952, for example, 30 States had programs active in reducing pest losses; cooperative Federal, State, and private programs were under way in 17 States; State and private programs with no Federal assistance were operating in three States; and Federal programs only were active in 10 States. Major cooperative State, Federal, and privately-sponsored programs were operated in 1953 to control the spruce budworm in Oregon, Washington, Montana, and Maine, the southern pine beetle in Mississippi, and the pine bark beetle in California.

The cost of pest control work in 1952 on Federal and non-Federal lands totaled about 7-1/2 million dollars; 27 percent was paid by the States and private groups, and 73 percent by the Federal Government. Participation by States and private groups has nearly doubled since the prewar period while Federal expenditures have gone up only about one-third. With greater and greater emphasis being placed on surveys and immediate action in control work, the need for large control programs such as have been active in the West in recent years may be lessened. Also, as the area of remaining old growth is cut over large scale insect attacks and the decay associated with over-maturity become less likely.

Forest Research

Research to provide sound technical knowledge for forest managers was one of the earliest forestry activities undertaken in this country. A comprehensive Federal-State program has been in operation for 25 years. The Federal Government, working through nine regional forest experiment stations and one forest products laboratory, has provided leadership and encouragement for other research groups, as well as a vast amount of research findings. Some States, through forestry departments, forestry schools, or agricultural experiment stations, have had forestry research programs under way, too. More recently, a number of private companies and organizations have initiated forest research activities. The combined work of all these organizations represents a sizable effort and a valuable form of assistance to forest landowners.

Contributions of technical knowledge in the field of timber production may well be one of the key factors in bettering the forest situation. Through research, information has become available on a vast number of involved ecological and biological relationships which influence forest reproduction and growth. Lack of such information has all too often resulted in timber losses through insects, disease, and fire. That more detailed and reliable information is now available about the location, extent, use, and need for timber is attributable to research studies in forest economics. More efficient fire control techniques have resulted from forest fire research. The gradual accumulation of findings on the relation of timber management to other land uses such as grazing, wildlife, recreation, and water yields is due to an integrated forest research effort. The improvement in processing methods and the increasing diversity of uses of timber reflect accomplishments in forest products research. Without such knowledge of the technical aspects of forestry, timber growers would be hard-pressed to know how to handle forest lands in order to maintain forest productivity at a high level.

Since 1940, forest research has become more and more a joint undertaking. A recent study by the Forest Service showed that in 1940, 58 percent of the research effort in forest management was by Federal agencies, while in 1952 the Federal participation had dropped to 47 percent. Contributions by industry and by the States have shown a definite upward trend, especially in the last few years. In numerous instances research projects are financed jointly by a number of agencies and industries. For example, the Forest Service reported 644 cooperative agreements for carrying on research projects with non-Federal groups in 1949. Almost 60 percent of these agreements were with private industry and 20 percent were with the State forestry agencies; the balance were with forestry schools and State agricultural experiment stations. The high percentage of projects carried on with forest industries and State forestry organizations points to the interest in, and need for, forest research as a form of forestry assistance to land-managing groups.

Industry and other assistance programs are for the most part of recent origin, and have expanded rapidly both in number and in participation by forest landowners. A large number of industry associations and conservation organizations are engaged in forestry assistance work of one type or another. The National Lumber Manufacturers Association, the American Pulpwood Association, the American Pulp and Paper Association, and numerous other trade associations employ foresters and give forestry assistance to their members and others. Then, too, conservation organizations such as the American Forestry Association, the Izaak Walton League, and the Western Forestry and Conservation Association, are active in forestry education. These are only examples of the large number of organizations which in the aggregate are having a strong impact on accomplishments in forestry.

The approach of these groups has been mainly through education programs. More recently, however, such groups have given more stress to direct contacts and on-the-ground advice. Thus, as the number of foresters employed by industry has mounted, direct assistance has taken on increasing importance. Examples of forestry assistance programs sponsored by some national, regional and local organizations not named above are:

American Forest Products Industries, Inc.

Organized in 1941 the AFPI carries on a nationwide forestry program. Its objective is to encourage woodland owners in growing timber crops and to inform the public of the activities of the forest industries. Through publications and by sponsoring specific programs, the AFPI reaches a great number of timber landowners and others interested in forestry. The two principal programs which this industry group is actively supporting are the American tree farm system and State fire prevention campaigns known as "Keep Green".

The American Tree Farm System

Inaugurated in the State of Washington in 1941, the American tree farm system is an industry-sponsored program to encourage wise woodland management and to stimulate public interest in growing timber as a crop. The tree farm movement spread from the West to the South in 1942, to the Lake States in 1944, and to New England in 1950. By 1953 there were tree farms in 36 States.

Since 1949, the number of tree farms has increased more than sevenfold, and the area of forest land in the program has more than tripled. As of August, 1954, there were 31-1/2 million acres of forest land and 5,408 tree farms. The area in tree farms constitutes 9 percent of the private commercial forest land in the United States. This percentage varies considerably by regions. The highest proportion of private land in tree farms is in the West with 25 percent, and the lowest is in the North with 2 percent.

Area of commercial forest land in private ownership

	Total (M acres)	Participation in tree farm program (M acres)	Private commercial forest land in tree farm program (Percent).
Section:			
North	141,615	2,608	2
South	176,609	18,923	11
West	40,026	9,919	25
Total	358,250	31,450	9

To be included in the tree farm system, a tract must meet certain forest management standards prescribed by a specially designated tree farm committee in each State. Management standards include protection from fire, insects, disease, and grazing; harvesting of mature timber so as to assure a continuous crop; thinnings to improve quality; and planting on idle land. Inspections for compliance with approved standards are made without charge by qualified private and State foresters. West Coast tree farms are inspected every year. In some States, though, there has been no reinspection. When an owner does not comply with management standards he is dropped from membership. Up to 1954, 245 tree farms with 1.2 million acres had been dropped because of change in ownership status or failure to maintain management standards.

Keep Green

Designed to enlist public support for forest protection and improve fire prevention, the Keep Green program is primarily educational in scope. This program began in the State of Washington in 1941 and later spread to 36 States. Industries, business firms, organizations, public agencies, and private citizens of all ages participate. The campaign acquaints people with the value of trees, the contributions that forests made to the economy of the respective States and to the Nation, the danger and destruction of forest fires, and emphasizes that a great majority of forest fires are man-caused and can be prevented. Keep Green organizations have become a strong force in creating public awareness of the need for fire prevention.

Trees for Tomorrow

Founded in 1944, Trees for Tomorrow, Inc., is a nonprofit, semi-public organization having as an objective the building of a sound forest economy in central and northern Wisconsin. Thirteen paper mills and five power companies sponsor and finance the organization. Their program involves both conservation education and technical assistance. Through the employment of a full-time executive secretary and a small staff of foresters, the organization operates numerous projects.

In conservation education, the center of interest and activity is a camp at Eagle River, Wisconsin, which is leased from the Forest Service. Here teachers, college and high school students, delegates of civic and service clubs, and industry groups assemble and learn about timber resource management.

Assistance to woodland owners includes the preparation of management plans for small holdings, making available tree planting machines, and distributing free annually close to one-half million trees. Since Trees for Tomorrow was started 10 years ago, it has distributed over 6 million trees, prepared management plans for about 122,000 acres of timberland, and helped establish 34 school forests.

Southern Pulpwood Conservation Association

The purpose of this Association is to encourage the wise use of the southern forest resource. Emphasis is mainly on fire, insect, and disease control and on evaluation and improvement of cutting practices. Organized in 1939, the Association is sponsored and financed by 26 pulp and paper companies. The membership includes 37 cooperating mills which use about 83 percent of all pulpwood produced in the South, 139 wood suppliers, and 18 associate members.

The program of the Association consists of two principal activities of work: education and direct aid to landowners. One special feature of the education program is the sponsoring of forestry training camps for farm youth. This project is active in nine States; the pulp and paper industry finances the program, and the State forestry agencies operate the camps. The Extension Service and Vocational Agricultural Department assist in selecting the boys and in providing supervision and instruction. In the neighborhood of 1,000 boys are reached each year.

In 1953, direct aid to landowners consisted of giving management advice to 5,681 landowners on 5.7 million acres, marking timber to be cut on 378,000 acres for 6,694 owners, and the distribution of 128 million trees. Some 42 million of these trees were distributed free of charge to small landowners by the industry. Approximately 125 industry-employed foresters were used in providing management advice and marking service to small landowners.

Industrial Forestry Association

The Industrial Forestry Association (successor in 1949 to the Joint Committee on Forest Conservation, West Coast's Lumbermen's Association, and Pacific Northwest Loggers' Association) is an organization representing the Douglas-fir industry in the Northwest. In cooperation with Federal and State agencies it has developed forest practice rules for the Douglas-fir region, most of which have been enacted into law by the States of Washington and Oregon. The Association founded the tree farm program in 1941 and helped enlist national support in extending this program to the entire country. Also, in 1941 the Association began, at Nisqually, Washington, a nonprofit forest tree nursery for providing planting stock to the Douglas-fir industry. In 13 years this nursery has shipped 64 million seedlings, most of which have been planted on industrially-owned forest land in western Washington and Oregon.

The Association's principal objective is the promotion in the Northwest of better forestry, including protection, management and utilization. It does this mainly through the West Coast tree farm program. It also works closely with the Forest Service, the Bureau of Land Management, the Indian Service and State forestry departments of Washington and Oregon. Cooperative efforts are directed at perfecting protection and encouraging public forestry education. In the last five years the Association has actively supported ad valorem taxation in Washington and Oregon, with the objective of holding on the tax rolls every privately-owned acre of commercial forest land capable of successful forest management.

The Association is governed by a board of directors consisting of 21 men elected by the subscribers and representing the lumber, pulp and paper, plywood, shingle and miscellaneous segments of the Douglas-fir industry. The executive of the Association is the chairman of the board of directors. The present board has nine professionally-trained foresters and the staff includes a manager, district foresters at Seattle, Portland and Eugene, specialists in forest taxation and forest genetics, and a secretary-librarian.

The services of the association are available without charge to any forest landowner in the Douglas-fir region for consultation. Many small landowners, as well as members of the industry, not members of the Association, are served each year in matters of timber growing, harvesting and utilization.

By 1954 the Association's West Coast tree farm program included 246 tree farms with a total area of 4,415,430 acres of forest land.

Forest Farmers Association

The Forest Farmers Association is a nonprofit organization of southern timberland owners and others interested in development and wise use of the area's forest lands. It was organized in Valdosta, Georgia, in 1941 "to protect and advance the interest of private forestry endeavor and to encourage full forest development." The Forest Farmers Association's membership now includes some 1,600 members who own approximately 50 million acres in the 15 southern States.

The program of the Association includes: national legislative activity, and educational work with southern timberland owners. In national legislation, the Forest Farmers Association has participated in successful efforts to secure more adequate public programs in fire control, reforestation, management, and research. The Association also supported important revisions to the Federal Internal Revenue code. Educational efforts of the Association include publication of a magazine, The Forest Farmer, sponsorship of field demonstrations, staging of an Annual Southern Forestry Conference, work with schools, and issuance of a Forest Farmer Manual.

Independent Timber Farmers of America

The Independent Timber Farmers of America, with headquarters in Minneapolis, Minnesota was organized a few years ago to serve individual forest owners whose holdings do not exceed 2,500 acres, and independent timber producers with annual output of not more than 2,500 cords of wood or 2½ million board feet of timber. It advises its members on good forest practices and cost-saving methods. It provides a timber trespass protective system. It furnishes market and price information, particularly for the northern sections of Minnesota and Wisconsin. Its membership, although largely concentrated in the Lake States, extends east to Massachusetts and south to Virginia.

New England Forestry Foundation

Sponsored by the Massachusetts Forest and Park Association, this organization has been providing a forestry service for New England landowners since 1944. The Foundation operates on a nonprofit basis and is incorporated under the Massachusetts law for charitable, educational, and scientific corporations. Any profits which accrue go back into the expansion of services. Essentially this Foundation serves the needs of timberland owners not employing technical foresters.

Currently 15 foresters are on the staff of the Foundation. They are located at 10 management centers. In 10 years, over 1,000 landowners have received assistance and about 250,000 acres of forest land have been put under forest management. Some 60 million board feet of timber have been cut from these lands. Much of the timber placed under management is in large estates and small holdings.

Connwood, Inc.

Another independently organized forestry service agency is Connwood, Inc. This is a forest products marketing association for Connecticut woodland owners established in 1945. Two foresters are employed. The association provides complete management service to small owners. Marketing is directed specifically at providing satisfactory outlets for products that can be cut in desirable silvicultural operations, including thinning of pine plantations. In addition to the sale of 1.5 million board feet of stumpage and logs to sawmill operators in 1954, a significant volume of business was done in highway and other fence posts, cedar poles, cordwood for roofing felt, Christmas trees, Christmas greens and other minor products. Other services include supervision of tree planting, running of boundary lines, woodland appraisals, etc.

Otsego Forest Products Cooperative Association

Organized in 1937 and originally financed by a government loan, the Otsego Forest Products Cooperative Association erected a permanent sawmill with dry kilns and finishing plant, to provide access to diversified lumber markets for small woodland owners of Otsego and adjacent counties in New York who desire to keep their woodland in good condition. The Association has about 1,000 members and markets about 2½ million board feet annually. It employs subprofessional field men who advise

woodland owners on cutting practices, and arrange for logging and hauling when the member does not wish to do his own work. The Association maintains a high standard of forestry practice, and returns good prices for logs delivered by members.

IMPACT OF FORESTRY ASSISTANCE

Public and private forestry assistance programs involve substantial annual expenditures and efforts by organizations and individuals. Likewise, the job of achieving a "high" level of productivity on all forest lands is substantial, too. This is especially true on small private forest holdings which include 265 million acres and which had only 40 percent of their operating areas in the "high" productivity class, according to a study made in 1953. Assuming that nearly all the medium and large forest landowners can afford the services of consulting foresters, there remain over 4 million small owners who periodically need some type of forestry assistance.

At the present time the numerous and diverse forestry assistance programs represent a sizable part of the total national effort in forestry. To what extent are these programs filling the need for such assistance?

Some indications of their impact are their recent accomplishments. Public assistance programs, although dating back 50 years or more, have achieved only limited coverage in most instances. During 1953 possibly 300,000, or 7 percent, of the forest landowners received some public assistance, mostly in the form of education. The number receiving on-the-ground advice or direct financial help through the Agricultural Conservation Program was about 34,000, or less than 1 percent of the more than 4 million small private forest landowners. Most of this assistance was in the East.

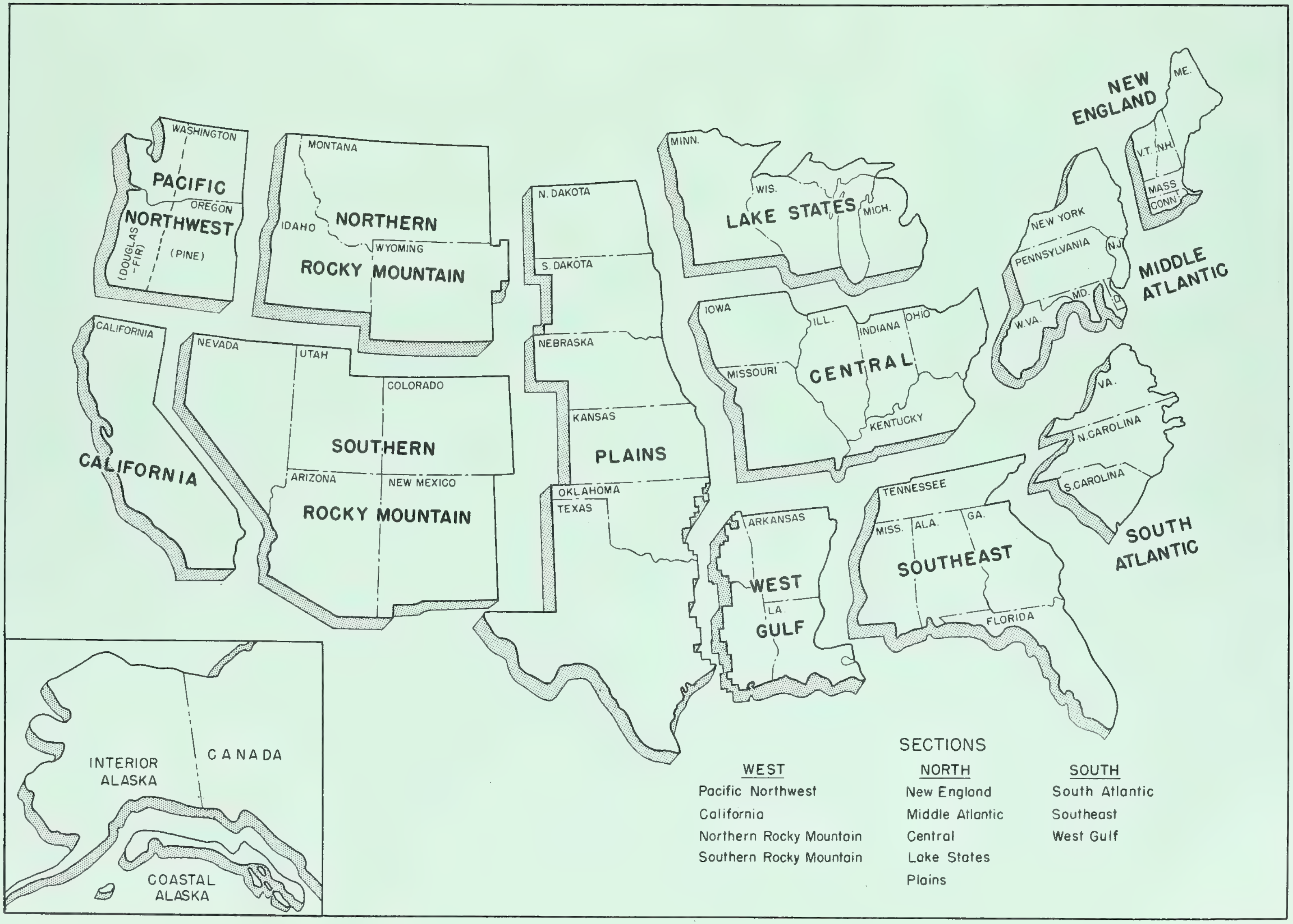
The most outstanding accomplishment of the public programs over the years has been in fire protection. For the years 1951-1953, for example, the forest area burned annually on State and private lands averaged less than one-half of what it did in the period 1941-1945. On the other hand, it is significant that in 1953, 53 million acres of forest land were still without systematic fire protection. Much of this area is in the South where small private forest holdings make up three-fourths of the total forest area in private ownership.

The Federal-State tree distribution program, which distributed 435 million trees in 1953, seemingly represents a major effort. It accounts for two-thirds of the trees planted on private land. Yet in relation to the planting needs, the present tree distribution program is small. Even with the current rate of natural restocking and with planting proceeding at the expected rate, it will take nearly 50 years to catch up on the planting job.

Private assistance programs have expanded rapidly, as has the number of foresters employed by private industry. The American tree farm system, reaching about 9 percent of the forest land in private ownership, is the largest industry-sponsored program. It is doubtful,

though, if in 1953 all private assistance programs reached more than 25,000 small private forest landowners--less than 1 percent of the total.

In summary, present progress and past accomplishments of the private and public assistance programs represent a noteworthy effort in American forestry. They are showing in numerous ways that assistance programs are an effective approach to better forestry on private lands. At this stage and with material currently available, a comprehensive appraisal of all the accomplishments of individual programs is not possible. It should be clear, though, that in the aggregate, gains being made on private forest land are in a considerable measure the result of the combined effort of all assistance programs.



Regions and Sections used in the Timber Resource Review

TIMBER RESOURCE REVIEW

CHAPTER V
SOME FACTORS INFLUENCING PAST CONSUMPTION OF TIMBER PRODUCTS

(Preliminary Review Draft Subject To Revision)

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INDEX TO TIMBER RESOURCE REVIEW REPORTS AND APPENDIX MATERIAL

(Each Chapter and each Section, in the case of Chapters IV and IX, is a separate document)

CHAPTER V. SOME FACTORS INFLUENCING PAST CONSUMPTION OF TIMBER PRODUCTS

(Preliminary review draft subject to revision)

By:

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September, 1955

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SOME FACTORS INFLUENCING PAST CONSUMPTION OF TIMBER PRODUCTS

INTRODUCTION

The preceding chapters have dealt with the Nation's current timber-supply situation and with existing programs that affect the supply outlook.

In this chapter and in the one to follow, attention has been shifted from timber supply to consideration of the demand side of the situation. The main task, undertaken in the latter of these two chapters, is to develop estimates of the future national requirements for timber products. But prior to doing that, it has seemed desirable to take account of some of the major influences that have affected past consumption of timber products.

The aspects of past consumption analyzed in this chapter include: (1) the timber-products consumption pattern of 1952, (2) timber-products consumption in perspective against the Nation's consumption of all raw materials, (3) a comparison of long-term trends of price against consumption, of lumber and of pulpwood products, (4) the amount of transportation now involved in moving timber products from places of production to ultimate consumers, with special attention to railroad transportation of lumber, and (5) trends in the substitution of timber products for other materials and of other materials for timber products.

THE TIMBER-PRODUCTS CONSUMPTION PATTERN OF 1952

The 1952 consumption of timber products for various uses in the United States, in terms of the volume of logs and bolts removed from forests, amounted to 12.2 billion cubic feet. Domestic forests supplied about 91 percent. The rest was received from foreign countries, chiefly Canada, in the form of lumber, pulpwood, woodpulp, and finished paper. These net imports of lumber, woodpulp, and paper are included in the 12.2 billion cubic feet, as equivalent volume of logs and bolts.

That total volume of wood consumed may be visualized as a bark-free solid block 1,000 miles long, 48 feet wide, and 48 feet thick. It was sufficient to provide each man, woman, and child of the population with 78 cubic feet.

The distribution of the timber consumed in 1952 by principal products--in terms of the commercial units of measurement and in terms of the volume of primary roundwood products (logs and bolts) brought out of forests--was as shown in table 1.

Of the total volume consumed, industrial wood (all products other than fuelwood) accounted for 83.6 percent. Sawlogs (for lumber, sawed construction timbers, sawed ties, and other sawed products) accounted

Table 1.--Estimates of timber-products consumption in the United States, 1952

Product	Standard unit of measure	Volume in standard units	Volume in roundwood 1/ products	
		Million	Million cu. ft.	Percent
Sawlogs (lumber, sawn ties, etc.)	Bd. ft. lumber tally	2/ 41,462	6,419	52.4
Veneer logs and bolts	Bd. ft. log scale	2,467	422	3.4
Pulpwood	Standard cords	3/ 35.4	2,697	22.0
Cooperage logs and bolts	Bd. ft. log scale	355.3	73	.6
Piling	Linear feet	41.2	28	.2
Poles	Pieces	6.5	88	.7
Posts (round and split)	do	306.0	194	1.6
Hewn ties	do	10.2	67	.6
Mine timbers (round)	cubic feet	81.0	81	.7
Other industrial wood 4/	do	227.0	168	1.4
All industrial wood			10,237	83.6
Fuelwood	Standard cords	58.6	2,008	16.4
All timber products			12,245	100.0

1/ The roundwood (logs and bolts) volume of pulpwood, of "other industrial wood," and of fuelwood includes only that cut directly from trees. Mill residues utilized for such products are part of the roundwood volume of sawlogs, veneer logs, etc.

2/ Includes net imports of lumber--1,752 million board feet, or the roundwood equivalent of 273 million cubic feet of sawlogs.

3/ Includes net imports of pulpwood, also of woodpulp, and finished paper expressed in terms of pulpwood. Net imports thus measured amounted to 11.2 million cords or 874 million cubic feet.

4/ All other timber products not including fuelwood.

for 52.4 percent, pulpwood for 22.0 percent, veneer logs and bolts for 3.4 percent, and all other industrial wood products for 5.8 percent.

Fuelwood cut directly from trees, including that cut from dead and cull timber, accounted for the other 16.4 percent of the volume consumed. The forest growing stock cut for fuelwood in 1952 amounted to slightly less than 10 percent of the total cut. Volume of sawlog-size material cut for fuelwood amounted to no more than 4.6 percent of the board-foot volume of the cut of saw-timber size trees. It is the industrial-wood segment of timber-products consumption that is of principal interest.

TIMBER PRODUCTS CONSUMPTION IN PERSPECTIVE

Information on the consumption of timber products becomes more meaningful when brought into perspective against the consumption of other kinds of raw material. What does the consumption of timber look like alongside the consumption of nonfuel minerals, for example? What is the relative importance of timber in the total of raw materials consumed in the United States?

The chief difficulty in finding the answer to such questions is obvious. Cubic feet of timber, tons of mineral ore, and barrels of crude oil cannot be compared one with another, nor can they be added to give a total. Conversion of various quantity units to some common unit of weight or volume would not help very much, because some materials have a high value per quantity unit while others have a low value. Quantity comparisons made on such a basis would have little significance.

The best solution, so far available, to this problem of comparing physical quantities of unlike materials is one developed by the President's Materials Policy Commission,1/ and used more recently by the Bureau of the Census.2/ It involves the conversion of physical quantity measured in conventional units to a common basis that does take account of the differences in value. This common unit of quantity, used by the Commission is that quantity of each class of material which could have been purchased for one dollar at its 1935-39 national average price. The quantities of various materials consumed annually were thus converted from their conventional units of measure (board feet, tons, barrels, etc.) to what may be called the equivalent "constant-dollar quantity units."

The price used in making this conversion was the one applicable to each material after the first major step in its production--timber products as logs and bolts at roadside, minerals at the mine ready for shipment, agricultural materials as they left the farm.

1/ The President's Materials Policy Commission, RESOURCES FOR FREEDOM, Government Printing Office, Washington, D.C. 1952. Vol. II, PP. 170-185.

2/ U.S. Department of Commerce, Bureau of the Census, RAW MATERIALS IN THE UNITED STATES ECONOMY, 1900-1952, Washington, D.C. 1954.

While prices in some period more recent than 1935-1939 would have been preferable, the data available for later periods (not influenced by World War II) were inadequate for the purpose.

The conversions of quantities consumed from conventional units to constant-dollar quantity units were done product by product to minimize distortions that would arise from shifts in the product composition of classes of material. Timber, for example, was broken down into sawlogs for lumber, pulpwood, fuelwood, and "all other." Materials imported for consumption in semi-finished and finished form were converted to equivalent quantities of their constituent raw materials.

While these conversions of physical quantity to a common-unit measurement give results that are only approximate, they do provide a basis for clearer understanding of the differences in the consumption trends of various classes of raw material, and of the general trend of total raw-materials consumption.

CHANGES IN THE MIX OF RAW MATERIALS CONSUMED, POSITION OF TIMBER

Measured in terms of constant-dollar quantity units, the mix of raw materials consumed by the national economy during the period 1900-1952 changed as shown in figure 1. The chart at the top of figure 1 shows the percentage composition of the total raw-materials intake broken down into the three major types of materials--foods, energy materials, and physical-structure materials.

Foods include those obtained from fisheries as well as those from agriculture. Energy materials include those used for production of heat, power, and light. The physical-structure raw materials, including all others except gold, provide the substance of things we make and use.

Fuelwood, of course, is one of the energy materials. All other timber products are in the physical-structure materials class.

Looking now at the over-all picture of relationships in raw materials consumption, it is apparent that energy materials (percentagewise) have increased considerably. Foods have decreased considerably. Physical-structure materials have shown greater variation than either of the other two types, especially during the 1930's. But recently they have represented about the same proportion as in the 1900's.

The chart in the middle of figure 1 shows the changes in the percentage composition of the energy-materials intake. Fuelwood, in the early 1900's, comprised a major part of energy material consumed. Since that time, our relative dependency on wood as a source of heat, power, and light has steadily declined. In 1950-1952 it represented a rather minor part of energy material consumed. While wood is still an important energy material in certain localities and for certain uses, it is no longer a major source of the Nation's total energy supply. The remarkable feature of energy-material consumption is the rapid increase of our dependency on oil and gas.

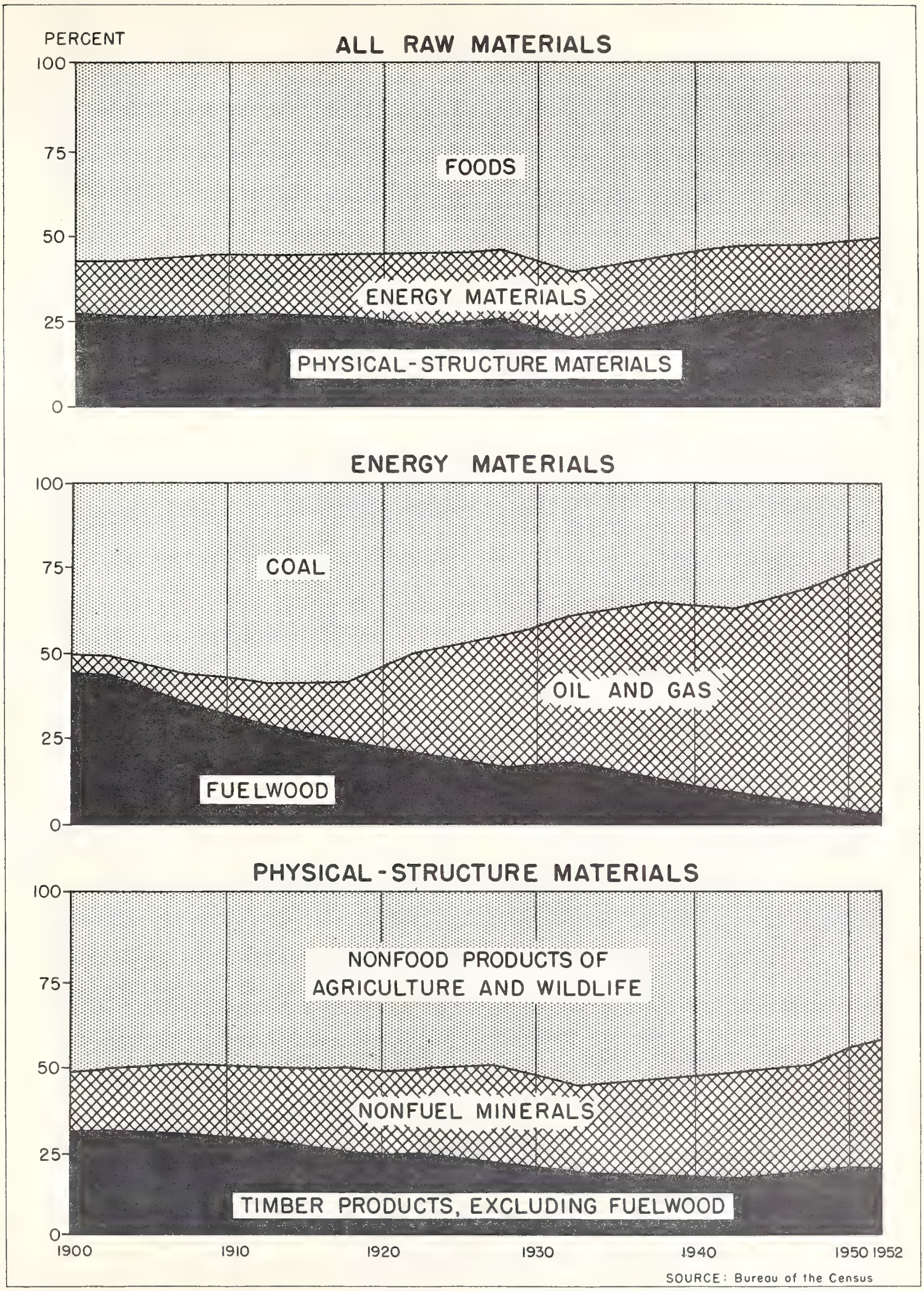

Fig. 1 - The mix of raw materials consumed in the United States, 1900-52.

The chart at the bottom of figure 1 shows the changes in the percentage composition of the physical-structure materials intake. Timber products (other than fuelwood) comprised close to one-third in the early 1900's. That portion shrank quite steadily from 1910 to 1929. In the 1930's and early 1940's, it contracted still further to slightly more than one-sixth; then the shrinkage trend was reversed. In the period 1950-52, timber comprised about a fifth of the physical-structure raw-materials intake.

RATES OF CHANGE IN THE CONSUMPTION OF PHYSICAL-STRUCTURE MATERIALS

Attention, so far, has been confined to changes in timber's relative position in the raw-materials intake. Figure 2 presents a comparison of the rates of change in the consumption of the physical-structure materials. Those changes are plotted on a ratio scale on which the upward and downward movements of the several curves represent equal percentage changes.

The trend in timber products consumption, expressed as cubic feet of logs and bolts, has been different from that of other classes of physical-structure materials. The upsurge of demand in World War I did not result in a corresponding increase of consumption--in fact, there was some decline. This was due in part to lack of demand and also to production difficulties brought on by labor and equipment shortages. The economic slump that followed World War I had somewhat less effect on timber consumption than on the other materials. But in the recovery of the later 1920's, timber consumption failed to regain its prewar levels, while consumption of the other materials did surpass prewar levels. The Great Depression was characterized by a sharp drop in the consumption of all physical-structure materials, but the percentage drop in consumption of timber products was not quite as drastic as that of the nonfuel minerals. It was more drastic than for the nonfood products of agriculture. Recovery in consumption of timber products in the later 1930's was slower and less complete; in fact, timber consumption did not approach the peak of the 1900's until 1942. That was followed by a decline in 1943-1945 and then an increase with a minor dip in 1949.

The 1950-1952 level of consumption of timber products (other than fuelwood) has been above any level attained in the past. The impetus, as will be observed later, has been supplied by pulp products, plywood, etc. Lumber consumption has approached the peak levels of the 1900's but it has not exceeded them.

RELATION OF WHOLESALE PRICE TO CONSUMPTION

The impact of price change upon the demand for a timber product is exceedingly difficult to judge--partly because of the limitations of suitable price and consumption data on the nationwide basis, and partly because of the difficulty of statistically isolating the influence of price from the influence of nonprice factors.

Existing price data are chiefly price-at-mill rather than price at place of consumption. Prices paid by the ultimate consumer contain the added costs of transportation and distribution.

Fig. 2 - Annual consumption of all physical-structure raw materials, and of specified kinds of such material, 1900-52.

About the best that can be done under present circumstances is to present some rough comparisons of wholesale price trends against consumption trends for the limited inferences that can be drawn therefrom. Even this involves a number of complications that will now be pointed out.

Over the years, the dollars-and-cents price of a particular timber product has been affected by the changes in the general purchasing power of the dollar. A valid comparison of the long-term relationship of price to consumption requires that such changes be taken into account. In other words, it is the "real price" of the product and not the nominal price that is the more meaningful in the present context.

CHANGES IN LUMBER'S REAL-PRICE INDEX, 1900-1954

The changes in lumber's average annual nominal price and of its corresponding real price (in terms of the general wholesale commodity-purchasing power of the dollar) over the period 1900-1954 are shown in table 2. The base (100.0) of the index of nominal price is lumber's average wholesale price in 1926. The corresponding base of lumber's real price is the 1926 relationship of lumber prices to all commodity prices.

The upward and downward shifts in real price of lumber are plotted in figure 3. In terms of 5-year averages, lumber's index of real price has advanced from 69.0 in the period 1900-1904 to 197.4 in the period 1950-1954.

The first upward thrust of price came in 1905 and 1906 when lumber consumption reached its all-time peak. This was followed by an equally sharp decline that lasted until 1910. There was a moderate rise in the years 1911-1913 followed by a further decline in 1917 to its lowest point in the 54 years under observation.

After a slight rise in 1918, real price shot up in 1919 and 1920 faster (percentagewise) than it has ever done in any 2-year period. This was followed by a sharp decline in 1921, and another rise in 1922 and 1923. From 1924 onward to 1932, there was a series of erratic movements on a general downward trend.

The period 1933-1950 was characterized by a fairly steep upward climb but with four moderate set-backs. From the all-time price peak reached in 1950, there has been a moderate decline in the period 1951-1954.

ABSOLUTE CONSUMPTION AND RELATIVE CONSUMPTION, CHANGES IN RELATIVE CONSUMPTION OF LUMBER

A somewhat comparable transformation of data is required on the consumption side. The absolute annual consumption of lumber, for example, has of late reached levels not far below the peaks attained in the period 1900-1910. It is well known, however, that the per capita consumption of lumber is now far below what it was at that time. The reason that absolute consumption can be high despite the decline in per capita consumption is, of course, due to the fact that the Nation's population and its economy has been expanding at a fairly rapid rate. A comparison

Table 2.--Indexes of nominal price and of real price of lumber, 1900-54

(1926 = 100.0)

Year	All commodity price index	Lumber price index		Year	All commodity price index	Lumber price index	
		Nominal	Real 1/			Nominal	Real 1/
1900	56.1	38.1	67.9	1930	86.4	85.8	99.3
1901	55.3	38.3	69.3	1931	73.0	69.5	95.2
1902	58.9	40.3	68.4	1932	64.8	58.5	90.3
1903	59.6	42.8	71.8	1933	65.9	70.7	107.3
1904	59.7	40.3	67.5	1934	74.9	84.5	112.8
1905	60.1	42.8	71.2	1935	80.0	81.8	102.3
1906	61.8	52.3	84.6	1936	80.8	87.0	107.7
1907	65.2	52.4	80.4	1937	86.3	99.7	115.5
1908	62.9	48.6	77.3	1938	78.6	87.4	111.2
1909	67.6	48.6	71.9	1939	77.1	93.2	120.9
1910	70.4	48.4	68.8	1940	78.6	102.9	130.9
1911	64.9	47.6	73.3	1941	87.3	122.5	140.3
1912	69.1	50.9	73.7	1942	98.8	132.8	134.4
1913	69.8	54.0	77.4	1943	103.1	141.4	137.1
1914	68.1	49.9	73.3	1944	104.0	153.3	147.4
1915	69.5	48.7	70.1	1945	105.8	155.1	146.6
1916	85.5	55.1	64.4	1946	121.1	178.4	147.3
1917	117.5	72.2	61.4	1947	152.1	277.6	182.5
1918	131.3	83.5	63.6	1948	165.1	313.0	189.6
1919	138.6	113.0	81.5	1949	155.0	286.0	184.5
1920	154.4	165.2	107.0	1950	161.5	327.4	202.7
1921	97.6	88.9	91.1	1951	179.8	351.4	195.4
1922	96.7	99.1	102.5	1952	174.8	344.4	197.0
1923	100.6	111.8	111.1	1953	172.5	341.0	197.7
1924	98.1	99.3	101.2	1954	172.8	335.2	194.0
1925	103.5	100.6	97.2				
1926	100.0	100.0	100.0				
1927	95.4	93.1	97.6				
1928	96.7	90.5	93.6				
1929	95.3	93.8	98.4				

1/ Obtained by dividing lumber's nominal price index number by the corresponding all-commodity price index number.

Source: Bureau of Labor Statistics Wholesale Price Index: Lumber and All Commodities, 1913-54. Data for 1900-12 from Bureau of the Census, RAW MATERIALS IN THE UNITED STATES ECONOMY, p. 90, converted to 1926 base.

Fig. 3 - Changes in the real (wholesale) price of lumber, 1900-54

of real price with consumption requires that the Nation's general economic expansion be taken into account. It is the "relative consumption" of the particular product--not the absolute consumption that is the more significant in the present analysis.

The method used in this study for estimating the relative consumption of timber products (other than fuelwood) makes use of the recent Census Bureau estimate of the 1900-1952 annual consumption of all physical-structure raw materials.3/ The relative consumption of lumber, for example, has been expressed in terms of board feet per constant-dollar quantity unit of physical-structure materials consumed.

While the results of this analytical method are admittedly rough, they do provide a consumption index that takes account of the Nation's expanding demand for raw materials.

The annual absolute consumption of lumber and corresponding relative consumption during the period 1900-1952 are shown in table 3. Absolute consumption of all physical-structure raw materials is also shown for reference purposes.

The periodic change in relative consumption of lumber can be summarized by saying that the composite constant-dollar quantity unit of all physical-structure raw materials consumed in 1900-1904 contained 19.1 board feet of lumber. In the period 1949-1952, it contained 7.3 board feet.

It is of interest to notice that the steeper part of the decline in relative consumption of lumber occurred during the period 1900-1932 (fig. 4). With the exception of the sharp downward plunge in 1937, the period 1933-1952 has been characterized by a slackening in the rate of decline.

The period of most rapid decline in relative consumption (1900-1932) witnessed a slower general increase in real price than has occurred in the period 1933-1952 when relative consumption declined more slowly. The earlier period, however, had some extremely violent fluctuations of real price.

RELATIONSHIP OF REAL PRICE TO RELATIVE CONSUMPTION OF LUMBER

The index of lumber's real price (table 2) and the estimated relative consumption (table 3) are plotted graphically in figure 5.4/

3/ Raw Materials in the United States Economy, 1900-1952.

4/ This type of chart, using ratio (logarithmic) scales on both horizontal and vertical axes, is a useful device for showing the relationship of percentage change in one variable (price) to percentage change in the other variable (relative consumption).

Table 3.--Estimated absolute consumption of lumber and of all physical-structure raw materials and relative consumption of lumber, 1900-52

Year	Absolute consumption: Lumber[1]	Absolute consumption: Units of physical-structure material[2]	Lumber consumed per unit of physical-structure material[3]	Year	Absolute consumption: Lumber[1]	Absolute consumption: Units of physical-structure material[2]	Lumber consumed per unit of physical-structure material[3]
	Billion bd. ft.	Million	Bd. ft.		Billion bd. ft.	Million	Bd. ft.
1900	41.0	1,979	20.7	1930	30.0	2,967	10.1
1901	41.5	1,915	21.7	1931	21.4	2,883	7.4
1902	42.0	2,375	17.7	1932	17.3	2,054	8.4
1903	42.0	2,231	18.8	1933	18.6	2,131	8.7
1904	41.5	2,496	16.6	1934	17.7	1,834	9.6
1905	42.4	2,453	17.3	1935	23.4	2,619	8.9
1906	45.0	2,635	17.1	1936	25.7	2,900	8.9
1907	44.7	2,427	18.4	1937	25.8	3,985	6.5
1908	40.8	2,425	16.8	1938	23.7	3,037	7.8
1909	43.6	2,621	16.6	1939	28.4	3,490	8.1
1910	43.4	2,760	15.7	1940	34.3	4,026	8.5
1911	41.3	2,641	15.6	1941	36.2	4,908	7.4
1912	43.2	2,767	15.6	1942	43.9	4,993	8.8
1913	42.0	2,636	16.0	1943	38.7	4,460	8.7
1914	38.6	2,905	13.3	1944	34.6	4,706	7.4
1915	36.7	2,587	14.2	1945	30.6	4,173	7.3
1916	39.7	2,856	13.9	1946	33.5	4,379	7.7
1917	35.8	3,090	11.6	1947	33.8	4,592	7.4
1918	32.0	2,875	11.1	1948	36.3	5,506	6.6
1919	34.2	2,678	12.8	1949	34.4	4,944	7.0
1920	34.6	3,242	10.7	1950	40.9	5,174	7.9
1921	28.5	2,130	13.4	1951	39.0	5,276	7.4
1922	34.9	2,611	13.4	1952	41.5	5,933	7.0
1923	40.5	3,209	12.6				
1924	38.5	3,069	12.5				
1925	40.2	3,331	12.1				
1926	38.8	3,432	11.3				
1927	35.9	3,092	11.6				
1928	37.7	3,327	11.3				
1929	33.9	3,455	9.8				

1/ Forest Service estimates of apparent consumption based on estimated production, less exports, plus imports. Adjustments for changes in lumber stocks during period 1929-52.

2/ Measured in terms of 1935-39 constant-dollar quantity units. Bureau of the Census, RAW MATERIALS IN THE UNITED STATES ECONOMY, 1900-52, p. 81.

3/ Computed from lumber estimates in million board feet. Figures for relative consumption of lumber, in certain instances, would differ slightly from those shown if computed from the lumber consumption estimates here rounded to the nearest billion board feet.

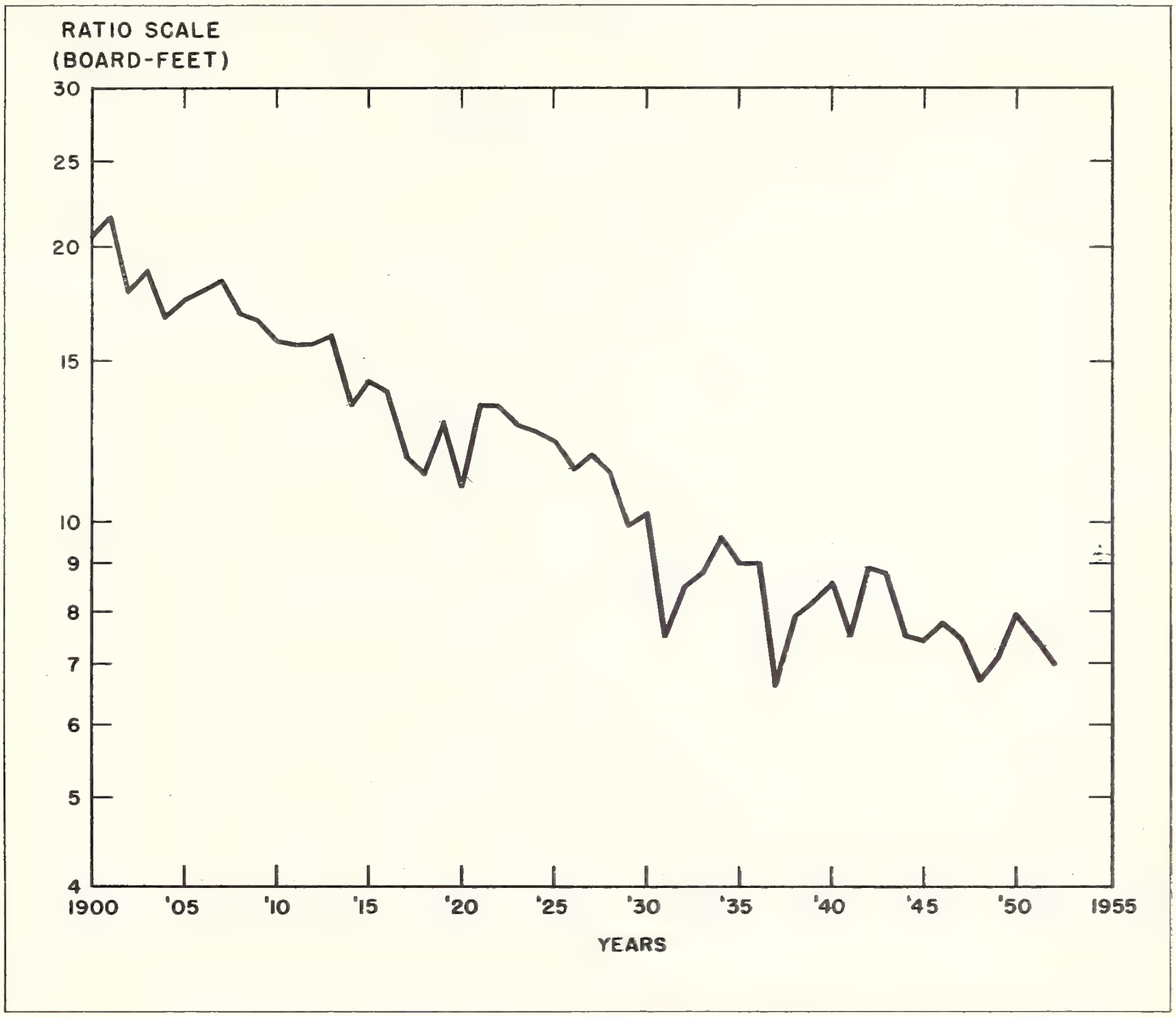

Fig. 4- Trend in relative consumption of lumber in terms of board-feet per constant-dollar quantity unit of all physical-structure materials, 1900-52.

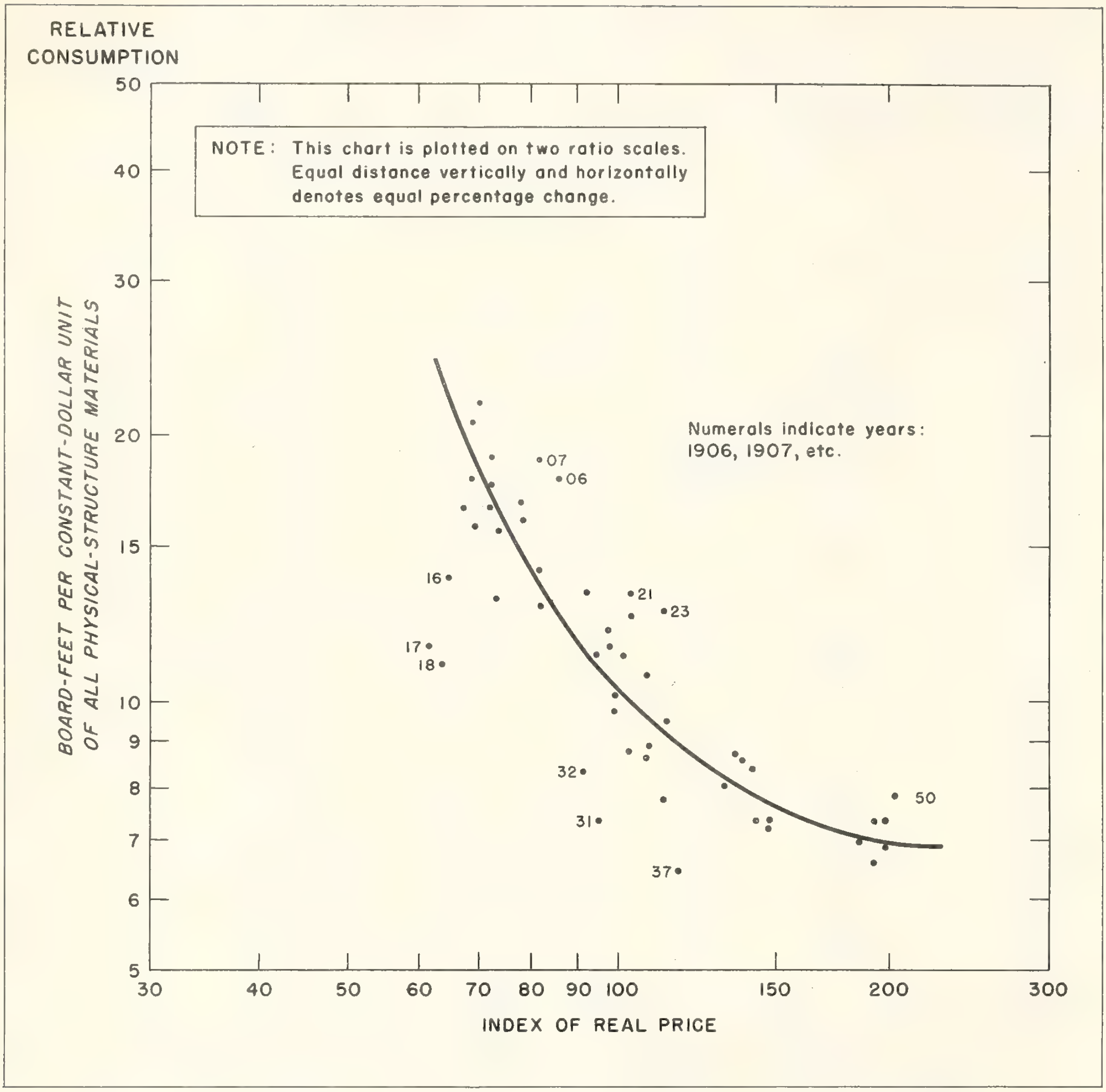

Fig. 5 - Relationship of real price to relative consumption of lumber, 1900-52.

The scatter-pattern of the dots indicating changes in price and consumption in relation to each other shows a fair degree of long-term consistency. As real price has risen, relative consumption has declined. During the first half of the 52-year period, the rate of decline in relative consumption (percentagewise) was greater than the rate of price increase. But during the latter half of the period, the rate of decline in relative consumption has been much less than the rate of price increase.

On the short-term basis, it is evident that lumber supply has been less flexible than lumber demand. The years 1906 and 1907 were a time of strong demand which stimulated a rise in price. The same was true in 1921 and 1923, and again in 1950. Prior to the Great Depression, the widest departures on the low side of the general price-consumption relationship were the World War I years, 1916, 1917, and 1918, when the rise in lumber prices was much less than the general increase in wholesale prices (table 3). This lag in real price-increase accompanied by a sag in relative consumption is explainable, in part at least, by the fact that volume of new private residential construction declined by 50 percent between 1915 and 1918.5/ The volume of all construction remained relatively stable, but the compensating construction activities were those that utilize relatively less lumber than residential building.

The low price and low relative consumption in 1932 and 1933 are more readily explainable by the fact that construction activity was at a very low ebb in those years.

The abnormal relationship of real price and relative consumption in 1937 was apparently due to a very complex set of factors. Real price was somewhat higher than it had ever been prior to that time, but residential building was also on the increase. Absolute consumption of lumber increased slightly from 1936 to 1937, but absolute consumption of all physical-structure materials increased very sharply from 1936 to 1937. In 1938 there was a short but severe economic recession that forced consumption of all physical-structure materials back almost to the 1936 level (table 3). Why these short-term changes occurred as they did need not be considered here.

The leveling-off in the price-consumption regression curve in recent years (fig. 5) has, apparently, been due to strong forces on the demand side. One obvious factor is the large volume of residential construction put in place since the end of World War II. One-third or more of all lumber consumed goes for that use.

While the rate of increase in the real price of lumber and the rate of decrease in the relative consumption of lumber do show a fair degree of consistency in their long term relationship, the ratio of the rate of price increase to the rate of consumption decrease has been changing. The data imply that forces on the demand side, for the time being at

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5/ U.S. Department of Commerce, STATISTICAL SUPPLEMENT — CONSTRUCTION AND BUILDING MATERIALS, May 1953, Page 40.

least, have been exerting much heavier pressure than in the early part of the 52 years under observation.

If real price continues its upward trend, there is probability of a continued downward trend in relative consumption. But any moderate decrease of relative consumption would still imply some increase of absolute consumption.

NOMINAL PRICE AND REAL PRICE OF PULPWOOD PRODUCTS, 1920-1954

In some respects, it would be best to make separate analyses for woodpulp, for paper, and for paperboard. That, however, has not been practicable. Some peculiarities of the existing index of woodpulp price are described in the footnote below.[6] Other price data available for the early part of the period under study rest on a pretty narrow foundation. Prior to 1929, the price index for paper was based on but two grades--newsprint and manila wrapping paper--and the price index for paperboard was based on three grades for "boxboard."

In view of such limitations of the price-data base, it seems probable that the composite index of prices for pulp, paper, and paperboard is more reliable for present purposes than the three indexes taken separately. It is, therefore, the composite index that has been used here as the general indicator of price change for pulpwood products in general.

The composite index of nominal price and a corresponding index of real price for pulp, paper, and paperboard, 1920-1954, are shown in table 4. The base (100.0) of these indexes is the average price during the year 1926. Real price is in terms of the general commodity-purchasing power of the dollar.

The real price of pulpwood products during the 34-year period under study shows some moderate fluctuations but virtually no upward or downward general trend (fig. 6). The most notable feature of this price trend is that it has kept coming back into line with the general trend of all commodity prices. Years in which the level of pulpwood-

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6/ The quantity of pulp that moves in the market-pulp trade represents less than 20 percent of total woodpulp consumption. Furthermore, the price of market pulp is much less stable than the price of pulpwood products in general. The instability has been due partly to the ups and downs in imports of woodpulp and partly to variations in the quantity of domestic woodpulp put on the market. Integrated domestic pulp and paper mills tend to put more pulp on the market during times when there is a lag in the demand for paper and paperboard. These factors are disturbing influences on the supply side of the market-pulp situation. Accordingly, the use of market-pulp prices as the sole indicator of pulpwood-products price would not be advisable.

Table 4.--Composite indexes of nominal price and of real price of pulp, paper, and paperboard, 1920-54

(1926 = 100.0)

Year	Nominal price	Real price 1/	Year	Nominal price	Real price 1/
1920	181.8	117.7	1940	91.7	116.7
1921	107.6	110.2	1941	98.2	112.5
1922	91.6	94.7	1942	100.8	102.0
1923	102.8	102.2	1943	104.1	101.0
1924	100.7	102.7	1944	107.1	103.0
1925	105.2	101.6	1945	108.8	102.8
1926	100.0	100.0	1946	119.4	98.6
1927	93.8	98.3	1947	155.1	102.0
1928	91.4	94.5	1948	168.5	102.1
1929	88.9	93.3	1949	160.8	103.7
1930	86.1	99.7	1950	163.5	101.2
1931	81.4	111.5	1951	198.0	110.1
1932	75.5	116.5	1952	2/ 197.6	113.0
1933	76.6	116.2	1953	197.0	114.2
1934	82.7	110.4	1954	197.3	114.2
1935	80.0	100.0			
1936	80.7	99.9			
1937	91.7	106.3			
1938	85.0	108.1			
1939	82.4	106.9			

1/ In terms of the general commodity-purchasing power of the dollar. Obtained by dividing the index number of annual nominal price by the corresponding index number for all commodity prices, as shown in table 2.

2/ The index from 1952 on includes a wider range of products under the title "Pulp, Paper, and Products."

Source: U.S. Bureau of Labor Statistics, Wholesale Price Indexes.

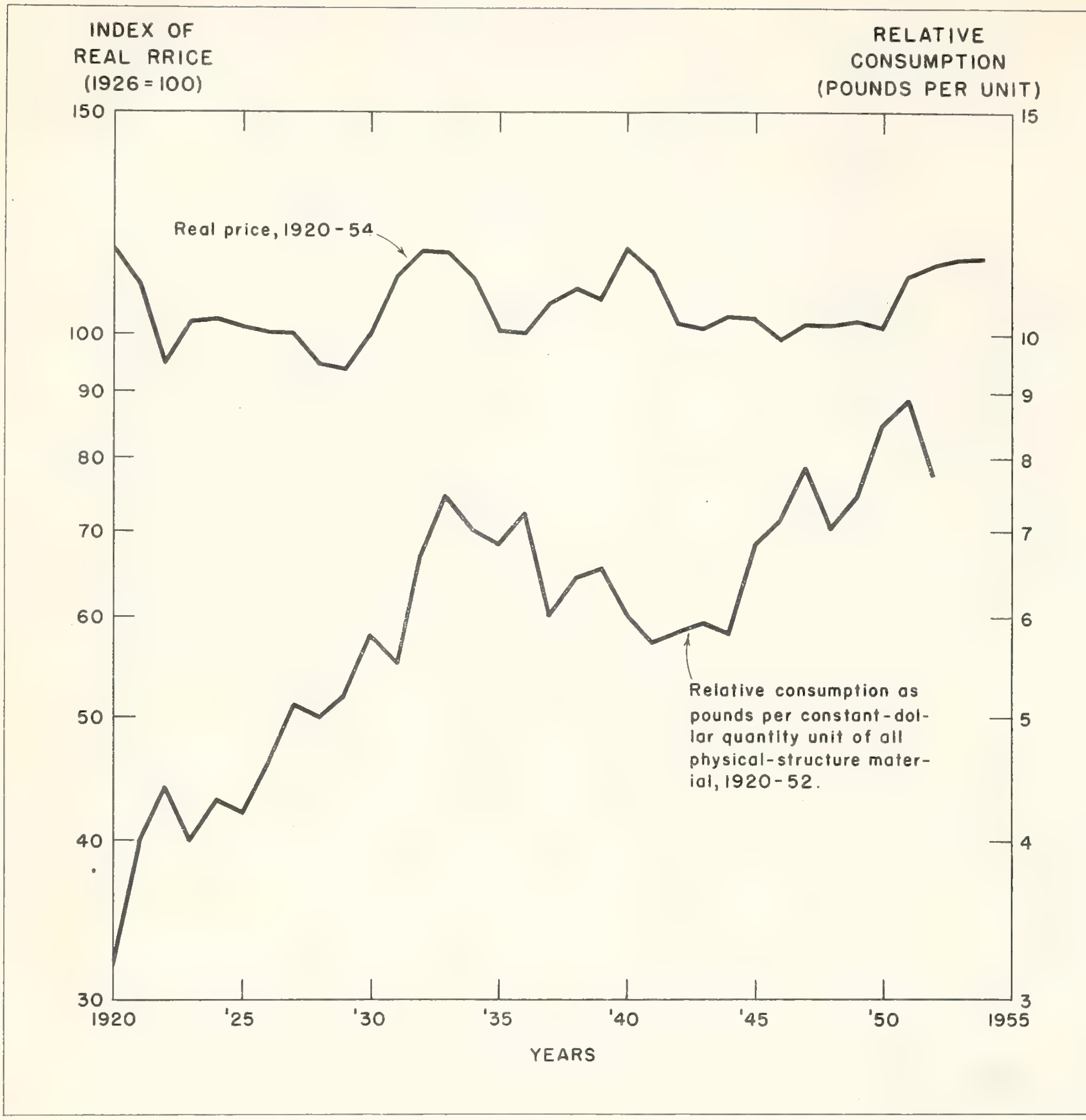

Fig. 6 - Trends of real (composite) price of pulp, paper, and paperboard and of relative consumption of wood pulp.

product prices and the level of commodity prices in general have been less than five index numbers apart include 1923-27, 1930, 1935-36, 1942-50. Such periods embrace 17 of the 35 years under observation (table 5).

It is of interest to note that during the depression years 1931-34 the prices of pulpwood products did not slump as much as did commodity prices in general. The difference in slump-resistance accounts for the higher level of real price of pulpwood products in the 1931-34 period. Nominal prices of pulpwood products did decline to some extent.

ABSOLUTE AND RELATIVE CONSUMPTION OF PULPWOOD PRODUCTS, 1920-1952

The decision to use the composite price index of pulp, paper, and paperboard makes it necessary to adopt a somewhat similar compromise with regard to the consumption trend. Woodpulp is, of course, the principal material in paper and paperboard.7/ The pulpwood-products consumption series has accordingly been expressed in terms of woodpulp. Net imports of finished paper and paperboard have been included in the woodpulp consumption estimates as equivalent tonnage of woodpulp.

The estimated annual absolute consumption of woodpulp, 1920-1952, and corresponding relative consumption are shown in table 5. Relative consumption is expressed in terms of pounds of woodpulp per constant-dollar quantity unit of all physical-structure materials consumed.

In the 32 years under study, absolute annual consumption of woodpulp increased from 5.2 million tons in 1920 to 22.8 million tons in 1952. The increase occurred at a fairly steady rate.

Relative annual consumption rose from the level of 3.2 pounds in 1920 to an annual average of more than 8.0 pounds in 1950-52. In other words, the composite constant-dollar quantity unit of physical-structure material consumed in 1920 contained 3.2 pounds of woodpulp; in 1951-52 it contained 8.0 pounds. This means, of course, that the consumption of woodpulp has increased much faster than the consumption of physical-structure materials in general.

The increase of relative consumption was very rapid from 1920 to 1933. This was followed by a downward trend until 1941 and then a rapid upward trend again until 1951 (table 5 and fig. 6). The drop that occurred in 1952, both in absolute and in relative consumption, may have been of limited significance.

It should, of course, be realized here that a substantial part of the increase in consumption of products of pulpwood has been the result of shifts from lumber to fiberboard and other pulpwood products. Part of

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7/ Certain grades of paper and paperboard do contain varying portions of fibrous material other than new woodpulp. The bulk of such material, however, is waste paper originally made from woodpulp.

Table 5.--Estimated absolute consumption of woodpulp and of all physical-structure raw materials, and relative consumption of woodpulp, 1920-52

Year	Absolute consumption: Woodpulp 1/	Absolute consumption: Units of physical-structure material 2/	Woodpulp consumption per unit of physical-structure material 3/	Year	Absolute consumption: Woodpulp 1/	Absolute consumption: Units of physical-structure material 2/	Woodpulp consumption per unit of physical-structure material 3/
	Million tons	Million	Pounds		Million tons	Million	Pounds
1920	5.2	3,242	3.2	1940	12.0	4,026	6.0
1921	4.3	2,130	4.0	1941	13.9	4,908	5.7
1922	5.7	2,611	4.4	1942	14.4	4,993	5.8
1923	6.5	3,209	4.0	1943	13.1	4,460	5.9
1924	6.6	3,069	4.3	1944	13.2	4,706	5.6
1925	7.0	3,331	4.2	1945	14.1	4,173	6.8
1926	7.9	3,432	4.6	1946	15.6	4,379	7.1
1927	7.9	3,092	5.1	1947	17.8	4,592	7.8
1928	8.3	3,327	5.0	1948	19.2	5,506	7.0
1929	9.0	3,455	5.2	1949	18.3	4.944	7.4
1930	8.6	2,967	5.8	1950	21.8	5,174	8.4
1931	7.9	2,883	5.5	1951	23.2	5,276	8.8
1932	6.9	2,054	6.7	1952	22.8	5,933	7.7
1933	7.9	2,131	7.4				
1934	8.2	1,834	7.0				
1935	8.9	2,619	6.8				
1936	10.5	2,900	7.2				
1937	11.9	3,985	6.0				
1938	9.7	3,037	6.4				
1939	11.3	3,490	6.5				

1/ Includes net imports of paper and paperboard in terms of equivalent tonnage of woodpulp.
2/ Measured in terms of 1935-39 constant-dollar quantity units. Bureau of the Census, RAW MATERIALS IN THE UNITED STATES ECONOMY, 1900-52, p. 81.
3/ In terms of pounds of woodpulp per constant-dollar quantity unit of all physical-structure materials consumed.

Source: U.S. Department of Commerce.

that shift has, no doubt, been induced by the rising real price of lumber.

The comparative high level of relative consumption maintained during the depression years 1932-33 indicates that consumption of pulpwood products was curtailed to a lesser extent than consumption of physical-structure materials in general. That feature accounts in part for the previously-mentioned fact that price of pulpwood products did not fall as much as did commodity prices in general.

THE PRICE-CONSUMPTION RELATIONSHIP FOR PRODUCTS OF PULPWOOD, 1920-1952

The trends of composite real price index for pulp, paper, and paperboard (table 4) and of relative consumption of woodpulp (table 5) have been plotted graphically in figure 6.

The most notable feature of the relationship between real price and relative consumption of pulpwood products is the fact that supply has increased so rapidly with no appreciable increase in real price.

That accomplishment, of course, has been due chiefly to technological advances which have greatly expanded the field of raw material suitable for manufacture of woodpulp. Not too long ago, spruce and fir were about the only timber species that could be so used. Modifications of the pulping process and the development of new processes have added the southern pines, jack pine, western hemlock, Douglas-fir, and many of the hardwood species to the raw-material base of the pulp and paper industry.

On a somewhat different front, impressive progress has been made in utilization of sawmill-residue wood for pulp, and in the production of pulpwood from thinning operations that speed up growth and improve the quality of stands of young timber. Both of these developments expand the raw-material supply.

Then too, on the consumption side, there has been equally significant technical progress in the development of new uses for woodpulp products and in the improvement of such products.

INFERENCE REGARDING IMPACT OF PRICE UPON CONSUMPTION

Scarcity of suitable price and consumption information over reasonably long periods of time for timber products other than lumber and pulpwood makes it seem advisable to limit the foregoing analyses to those two products. Lumber and pulpwood, however, accounted for 89 percent of the total 1952 domestic consumption of timber products other than fuelwood.

Many factors other than price have influenced consumption of lumber. Some of those other factors will be considered presently. While there is no reason to believe that the increase of real price has been the sole cause of the decrease of relative consumption, the foregoing

evidence is strong enough to justify the belief that real-price increase has been a major influence contributing to that decrease.

This inference is strengthened by the fact that the absence of any appreciable increase in real price of pulpwood products has been accompanied by an upward trend of relative consumption.

If, like that of pulpwood products, the real price of lumber had not increased, there is reasonable probability that relative consumption of lumber would not have decreased to anything like the extent it has. The main point to be stressed here is that any projection of past trends of lumber consumption automatically involves the assumption that there will be a further increase of its real price. Similarly, a projection of pulpwood consumption implies little or no increase of pulpwood price.

TIMBER-PRODUCTS TRANSPORTATION

One of the major handicaps to economical procurement of timber products (lumber in particular) has been the gradual increase in the amount of transportation required to bring such materials from places of origin to places of consumption.

This matter is touched upon here because there is a strong probability that the transcontinental hauling of timber products is approaching its peak. It is more than likely that the next fifty years will see a trend toward more intensive use of the forest lands of the East, which are comparatively nearer to the eastern concentrations of population and of industry.

The recent and continuing rapid growth of population and of industry in the West can be expected to increase the demand for timber products in that section. It seems more than likely that a diminishing portion of the western output will be available for shipment to other sections of the country.

Then too, the gradual shift of western lumber production from old-growth to young-growth timber will tend to reduce the present quality differences between western and eastern lumber. This should make it possible for the eastern product to compete more vigorously with the western in eastern markets.

Another consideration is that three-fourths of the Nation's commercial forest acreage, and about that much of its timber-growing potential, including more than half (57 percent) of the softwood-growing potential, is situated east of the Great Plains. Thus, the bulk of the forest land best suited for the production of timber products is favorably located with respect to the bulk of the Nation's population and of its industrial activity. There is no physical necessity that such a large cross-continent traffic in timber products be continued indefinitely.

The historical increase in the amount of transportation required with respect to lumber--and to some extent with respect to other timber products--was due to the shifting of the major areas of production. Commercial sawmilling began in the Northeast. From there, the center

of largest production shifted to the Lake States, then to the South, and finally to the West. Each successive shift has added some more transportation costs to the final price of lumber.

More than 63 percent of the Nation's 1952 output of softwood lumber and about 50 percent of its total lumber output occurred in the West. Some 34 percent of the Nation's total timber-products output in 1952 came from the western forests.

The general effect of more and more dependency upon timber supplies further and further away from the areas of largest demand for timber products has been to put a larger part of the consumer dollar spent on timber products into the hands of agencies of transportation and a smaller part into the hands of the producers of timber and timber products. There is a strong probability that this particular trend will halt and be reversed within the next fifty years.

The size of the Nation's total payments for the hauling of timber products in recent years cannot be estimated with precision, but some idea of its general magnitude can be inferred. We do know that the freight revenue earned by the railroads in 1952 by transportation of timber products amounted to more than one billion dollars.8/ About half of the lumber consumed in that year moved by rail over part of its journey from forest to final user. The bulk of the rail traffic was shipments from processing mills to distribution centers. The rail revenue earned by transportation of logs and bolts from forests to mills amounted to no more than 8 percent of the total earned by railroads in the hauling of timber products.

The bulk of the short-distance hauling of roundwood products from forests to mills is done by truck. The same is true with respect to hauling of processed materials from distribution points to places of final use. It appears also that about half of the total output of lumber moves by truck from mills to places of final use. Transportation of timber products by water, both in short and long-distance hauls, is of considerable importance.

Taking all these facts into account, it seems probable that not less than two billion dollars were spent on the transportation of timber products in 1952. The money paid to transport timber products undoubtedly exceeded payments for raw material on stump by a wide margin.

8/ U.S. Interstate Commerce Commission, STATISTICS OF RAILWAYS IN THE UNITED STATES, 1952, Government Printing Office, Washington 25, D.C., 1955.

SUMMARY OF RAILROAD FREIGHT-REVENUE INFORMATION

Because of the lack of statistical information on truck and water transportation of timber products, the forthcoming summary of transportation costs has to be limited to the rail hauls which probably represent about half of the ton-mileage of all the hauling done.

The billion dollars earned by the railroads from 1952 timber-products traffic has been mentioned. The distribution of that revenue by type of product and the average length of haul by type of product was as follows:

	Million dollars 1/	Average haul in miles 2/
Primary timber products (logs and pulpwood)	86.8	137
Processed timber products		
Lumber and wood products	581.2	1,058
Pulp, paper, and paperboard	353.2	721
All processed timber products	934.4	938
Miscellaneous (including firewood)	24.4	294
All timber products	1,045.6	..

1/ U.S. Interstate Commerce Commission, STATISTICS OF RAILWAYS IN THE UNITED STATES, 1952, Government Printing Office, Washington 25, D.C., 1955.

2/ Based on data compiled by the Interstate Commerce Commission from a 1-percent sample of waybills submitted by Class I railroads. The data, actually, are average haul per waybill. They understate the actual miles hauled to the extent that shipments have been rebilled during the course of the total rail haul. This factor, however, is probably not of major importance.

Interstate Commerce Commission, CARLOAD WAYBILL STATISTICS, 1952, Statement No. 5319, Washington 25, D.C., 1953.

Lumber's present competitive disadvantage with regard to length of haul is rather striking. The 1952 average (nationwide) railroad haul for lumber and for a number of its competing materials was as follows:

	Average haul in miles
Lumber (excluding other wood products)	1,173
Cement, Portland	161
Brick, building	367
Lime, common	297
Wallboard (chiefly gypsum)	501
All mineral building materials 1/	143
Iron and steel bars and rods	201
Manufactured iron and steel	460
Metal containers	324

1/ Includes a large tonnage of gravel, sand, and stone.

Of the total railroad freight revenue earned by hauling timber products, lumber accounted for $452.5 million or about 43 percent. The average lumber railroad haul was 1,173 miles, and the average revenue per thousand board feet was about $20.56.

The general pattern of lumber shipments by rail between major sections of the country and within sections is summarized in table 6.

Of the estimated 18.7 billion board feet of lumber moved by rail between points within the United States, some 7.5 billion were shipped from the West to the East (North and South as a whole).9/ The total freight paid on this West-to-East traffic is estimated at about $226 million. The average haul was 2,263 miles, and the average revenue per thousand board feet was $30.15. The West-to-East transportation of lumber by water is somewhat less than these costs, but the volume now moving in that traffic is not very large.

The reverse transcontinental rail movement of lumber from East to West (chiefly hardwood) was comparatively small--121 million board feet. The haul in this traffic averaged 1,800 miles, and the revenue per thousand board feet averaged about $33.60.10/

9/ See map on inside of back cover for sectional delineation of the United States.

10/ The shorter average haul in this traffic is due to the fact that much of the lumber moving in this East-to-West trade originated in the Lake States and in the Mississippi Valley. The relatively higher revenue per thousand board feet is due chiefly to the greater weight per thousand board feet.

Table 6.--Estimated tonnage and volume of lumber[1] carried by railroads, and reported freight revenue, average haul, and average revenue per ton and per thousand board feet, 1952

Shipment	Quantity terminated		Freight revenue	Average haul[4]	Average revenue[5]	
					Per ton	Per thousand board feet
	Thousand tons[2]	Million bd. ft.[3]	Thousand dollars	Miles	Dollars	Dollars
From domestic sources:[6]						
West to North	7,493	5,550	168,848	2,279	22.90	31.20
South to North	4,426	2,459	56,642	744	12.90	23.90
Within the North	2,355	1,744	14,478	376	6.20	8.40
Total terminated in North	14,274	9,753	239,968	1,490	16.80	24.60
West to South	2,622	1,942	57,104	2,217	22.00	30.00
North to South	188	104	1,887	1,203	9.90	18.80
Within the South	4,946	2,748	29,765	280	6.00	10.80
Total terminated in South	7,756	4,794	88,756	957	11.44	18.50
South to West	197	109	3,427	1,790	17.70	33.60
North to West	22	12	424	1,979	18.60	33.50
Within the West	5,462	4,046	52,484	642	9.70	13.00
Total terminated in West	5,681	4,167	56,335	687	9.90	13.50
West to North and South	10,115	7,492	225,952	2,263	22.34	30.15
Within the East (North and South as a whole)	11,915	7,055	102,772	486	8.63	14.55
Within and to the West	5,681	4,167	56,335	687	9.92	13.50
Total domestic shipments	27,711	18,714	385,059	1,173	14.20	20.56
Apparent imports by rail	3,222	2,387	[7] 67,433	([10])	20.90	28.25
Total shipments	[8] 30,933	21,101	[9] 452,492	..	14.63	21.44

1/ Include shingles and lath; excludes railroad ties which are reported separately.
2/ Based on a 1-percent sample of waybills. See footnote 6.
3/ Reported tonnage converted to volume by use of rough average weights per thousand board feet.
4/ Understates actual haul to the extent that shipments are rebilled during transit from point of origin to point of final destination.
5/ Understates actual revenue per unit for reason mentioned in previous footnote.
6/ Allocation based on U. S. Interstate Commerce Commission, CARLOAD WAYBILL STATISTICS, 1952, Statement No. 5330, Washington, D. C. 1953.
7/ Revenue of United States railroads only. But includes revenue on lumber shipped by rail to Canada and Mexico. This may approximately balance revenue of foreign railroads on United States imports.
8/ Includes an estimated 900 thousand tons terminated by Class II railroads, and 30,033 tons reported terminated by Class I railroad; Interstate Commerce Commission Statement No. 5311. Calendar year 1952.
9/ U.S. Interstate Commerce Commission, STATISTICS OF RAILWAYS IN THE UNITED STATES, 1952. Revenue of Class I and Class II railroads. (Tables 51 and 51-B)
10/ Not reported.

The volume of lumber moving by rail between points within the East is estimated at slightly more than 7 billion board feet. The freight revenue earned in such traffic is estimated at about $103 million. The average haul was 486 miles, and the average revenue per thousand board feet was $14.55.

Transportation-cost Advantage of Eastern Lumber within the East

The volume of lumber shipped by rail from West to East was somewhat larger than the volume that moved by rail between points within the East. But the railroad freight bill paid on the West-to-East traffic was considerably more than twice the amount paid on the eastern internal shipments.

If the West-to-East volume (and quality) of lumber could have been obtained from eastern sources at average eastern rail transportation costs, the transportation-cost saving would have amounted to about $117 million or about $15.60 per thousand board feet. This $15.60 per thousand board feet is the approximate rail-transportation cost advantage that eastern lumber has in eastern markets over the western product. This figure, of course, is based only on the rail traffic. Since more than half of the eastern lumber moves from mill to consumer by shorter truck haul, the actual average freight-cost advantage of eastern producers in eastern markets is substantially more than $15.63 per thousand board feet.

The competitive advantages of the western producers lie in higher average quality of product, in lower processing costs, and in lower costs of standing timber.

However, if eastern forest owners and lumber producers could gradually capture a substantial part of the $117 million paid annually by eastern consumers for the extended haul of lumber from the West, that amount of money would pay for a lot of effort toward expanding and improving the timber supply of the East.

The foregoing discussion should, by no means, be taken as an argument against the transcontinental transportation of lumber or of any other commodity. It does seek to present the best information available regarding the rail-transportation cost factor that now enters into price of lumber to the ultimate consumer.

The gradual attainment of more balance between timber production and timber consumption in the West, the South, and the North would have several important economic effects. It should bring about a substantial reduction in the long-distance hauling of timber products. This should put a stop to the long-term influence that increases of hauling distance have had upon the upward climb in price of lumber to the ultimate consumer. If such a reduction of aggregate transportation of timber products does not result in some reduction in price to the ultimate consumer, it should, at least, permit a substantial shift of earnings from the agencies of transportation to the producers of timber and timber products.

SUBSTITUTION TRENDS, FAVORABLE AND ADVERSE TO TIMBER

The various trends toward substitution of timber products for other materials, of other materials for timber products, and of one timber product for another, are due to a complex combination of factors in which technological change and other nonprice influence is often deeply entangled with price influence.

The discussion to follow will point out some of the nonprice influences, but in the majority of shifts relative price has also been involved. Any attempt to measure the impact of change in relative price against the impact of nonprice influences would entail analyses of extreme complexity. Such a task could not be undertaken in the present study. A brief survey of the more important shifts without trying to weigh the underlying causes will have to suffice.

Technological changes affecting use of wood take many forms, and some have little to do with the comparative properties of wood and its competing materials. Then too, the displacement of wood from one type of use has often been balanced by the advent of another entirely new use for wood. A few random examples will serve to illustrate.

The wooden ship was displaced by the metal ship. But during the same period when iron ships were taking over the sea lanes, the railroads sprang up as the major form of land transportation. It is probably safe to say that the volume of wood under railroad tracks in the United States at the present time (around 40 billion board feet) is much greater than the volume that ever sailed the seas in the form of clipper ships.

The development of the automobile, composed almost wholly of metal, has virtually displaced the horse-drawn vehicle, composed chiefly of wood. But the automobile has led to the development of the modern highway system and to the ubiquitous advertising billboard--made chiefly of lumber. There is probably as much wood in billboards as was formerly contained in the vehicles displaced by the automobile.

There was a time when almost every family either had or hoped to acquire an organ or piano. That demand has waned, but the majority of families now possess radio, television, or record player sets. Many of those sets are encased in wooden cabinets. It is quite possible that the volume of wood now going into such cabinets is more than equal to the reduction in volume going into pianos.

The shifts illustrated above are highly unpredictable because they grow out of technological developments quite remote from the technology of timber-products utilization.

But within the field of wood technology there are a number of important trends that can be pointed out. These will be summarized under two headings: (1) those favorable to an expanded use of timber products, and (2) those adverse to the use of timber products.

The largest and most rapid expansion in the use of timber has been in the field of paper, paperboard, and nonpaper products of woodpulp and wood fiber. Next comes veneer and the products fabricated from it. With regard to lumber, the new uses are important but spotty. There have been few notable increases in the use of other timber products.

Expanding Uses of Paper and Paperboard

The original use of paper by the printing and publishing industry has continued to increase under the stimulus of mass advertising, despite stiff competition by other media such as radio and television. The success of the printers and publishers in holding a large share of business has been due, among other things, to better quality and versatility in the printing papers available to them and to new developments in the art of multicolor printing.

The most rapid increase in the use of paper, however, has been in connection with shipping and packaging. The multiwall paper bag, for example, has almost displaced the burlap and cotton bag as shipping container for a long list of bulk materials--Portland cement, lime and plaster, chemical fertilizer, poultry and livestock feeds, potatoes, flour, sugar, and many others.

The development of the self-service grocery store has led to use of large quantities of paper for the packaging of small quantities of foods of all kinds. Special containers like the wax-coated paper milk carton and the wax-coated carton for frozen foods are well suited for self-service merchandising of these two commodities. Housewives carry home millions of paper-wrapped packages in millions of paper shopping bags every week.

Another increasing use for paper and of purified wood fiber has been in the manufacture of articles of personal use--towels and napkins, facial and toilet tissue, absorbent packs, and various other items.

There has also been a large increase in the use of industrial papers. Tar-impregnated paper, for example, is used as wrapping to retard corrosion of underground pipe lines. A glued-on sheet of heavy paper is being used to improve the surface appearance and paintability of certain grades of plywood. Building paper is used extensively as a moisture barrier in walls and other parts of houses.

Any full listing of the expanding uses and the new uses for paper and paper products would be very long indeed. Consumption of paperboard has been increasing even more rapidly than paper. The major use is for fiber shipping cartons, which are generally cheaper and lighter than the wooden boxes and crates that are being displaced. The fiber carton is especially suited for truck transportation. Another advantage is that it can be folded flat for shipment and storage prior to use. The set-up job is simple and quick. Folding paperboard is now used as packaging material for consumer articles of all kinds.

Paperboards are also making headway in the construction materials field, but here they face stiff competition by several other types of wood-fiber board and by plywood.

Nonpaper Products of Woodpulp

With regard to the nonpaper products of woodpulp, a fairly clear distinction can be made between those which involve a dissolving process and those which do not.

While the tonnage of woodpulp used for dissolving purposes is less than for many other uses, the final products have high value. Rayon, of course, heads the list--comprising about 20 percent of the total quantity of textile fiber consumed in the United States. Rayon consumption continues to increase at a rapid rate. Cellophane, another product of dissolving pulp, has become an important wrapping material for many consumer items, including "prepackaged" cuts of meat. Dissolving pulp is the basic raw material for the manufacture of sausage casings, photographic film, smokeless gunpowder, certain lacquers and plastics, and a number of other derivatives.

Woodpulp, not chemically dissolved, is the felting material in asphalt shingles and roofing. Pulp board, perforated with small holes, is used as acoustical tile on the surface of ceilings to deaden noise. Woodpulp is used as the filler in certain plastic articles like cafeteria trays. It has quite a number of other uses.

Wood-fiber Boards

Consumption of the several types of wood-fiber boards has been growing very rapidly. One type of pulp board, used principally for thermal insulating purposes, is held together entirely by the felting properties of the wood fiber. Others require some binder—either the natural lignin fraction of the wood, which can be plasticized under heat and pressure, or some resin or other material.

Use of the lignin as binder has the advantage of simplicity and no additional cost, but board made by this process has low moisture resistance. Some resin binders (depending on the type and quantity used in mixture with the wood fiber) impart moisture-resistant properties. The density and thickness of these wood-fiber boards can be adjusted to a fairly wide range of specifications.

The output of wood-fiber boards during 1953 amounted to about 4.1 billion square feet. Plywood output, which has also been increasing rapidly, amounted to 3.25 billion square feet. To have covered the same square feet of surface represented by the output of wood-fiber boards with inch-thick lumber would have required about 10 percent of the total volume of lumber consumed in that year.

Veneer and Plywood

Plywood of various kinds has been manufactured for a long time. But, until about 20 years ago, its uses were drastically limited because the glues employed as bonding agent failed when exposed to moisture.

The discovery of moisture-resistant and moisture-proof synthetic resins and other adhesives opened a wide realm of new uses for plywood and veneer. Here is another instance in which technology somewhat removed from wood itself has had a remarkable impact upon wood use.

Plywood, bonded with moisture-proof adhesives, is now used extensively for concrete forms, as siding for prefabricated houses, and even as covering material for small boat hulls. Recent moulding techniques have made possible the manufacture of plywood to almost any (simple or compound) surface-curvature specifications that may be desired.

Plywood, bonded with moisture-resistant adhesive, is usually less costly to manufacture than the moisture-proof type. Such material is used extensively for many purposes where high moisture-resistance is not required--subflooring, sheathing, door panels, interior walls of prefabricated houses, and scores of other uses.

The new arts of gluing have opened possibilities for many new combinations of materials. Low-quality plywood can be upgraded and otherwise improved by masking one surface with plain or resin-impregnated paper, with sheet plastic, or sheet metal. Each combination gives some unique properties not otherwise possessed by the constituent materials.

It is to be expected that the uses of veneer and plywood will continue to expand in the years ahead.

Recent Developments in the Use of Lumber

Some of the more important developments in new uses for lumber stem from the new arts of gluing that were mentioned above.

The glued laminated wooden arch is being used, to considerable extent, as the main roof support for buildings that require large interior space unobstructed by crossbeams or pillars. Such buildings include gymnasiums, churches, aircraft hangars, and the like. Laminated rafters are being used for a similar purpose in barns, machine sheds, and other farm service buildings.

Another application of the laminating technique is in the fabrication of keel and ribs for small boats, and even for some sizeable craft such as minesweepers.

Methods for laminating preservative-treated lumber and for the preservative treatment of laminated members are now coming into commercial use. This opens a door to new possibilities.

Laminating techniques, of course, are not limited to the construction field. They are also being applied in the manufacture of specialties like skis, baseball bats, diving boards, and the like.

But more important than any of these, from the standpoint of quantity of lumber used, is the use of lumber in combination with plywood and wood-fiber board in fabrication of the "stressed-skin" panel used extensively in prefabricated housing. Such panels are composed of a light frame of dimension lumber to which a cover of plywood or other sheet material is glued. The cover, or skin, of the panel thus becomes integral with the frame and carries a large part of any stress that may be put upon it. Several of the systems of house prefabrication utilize the stressed-skin panel for outside walls, for inside partitions, and for other components.

The number of prefabricated dwelling units erected in 1954 was about 77,000 or 6.3 percent of total nonfarm dwelling units built. While the volume of lumber required for a stressed-skin-panel wall is less than would be used for conventional studding, the more important feature is that, so far, prefabricated housing has been made almost wholly of wood materials.

A somewhat similar observation is pertinent with respect to the roofing-material shift from wood shingles to asphalt shingles. The asphalt shingles require solid roof sheathing, whereas the wood shingles do not. Furthermore, the asphalt shingles are composed principally of wood-fiber felt. In the final accounting, the use of wood per square foot of roof has probably increased rather than decreased.

A quite different but fairly recent architectural innovation is the use of knotty-lumber paneling for interior finish in one or more rooms--usually a den, a recreation room, or a part of some other room. This decorative touch or some other application of wood in natural finish is more likely to be confined to the more expensive houses. Knotty-lumber paneling is being used to a limited extent in restaurants and taverns and in some other commercial buildings.

Outside the construction-materials field, one of the more important new uses for lumber has been for pallets. These are the accompaniment of the fork-lift truck and other devices used for more rapid and efficient handling of goods in factories, warehouses, and in shipment of packaged goods. It is relatively certain that the demand for pallet lumber will increase for some time as more establishments adopt the new methods for handling materials.

One more factor may be worthy of mention. It is the do-it-yourself trend that stems partly from the increase in home ownership, partly from the increase of leisure time, partly from the development of power tools for basement workshops, and partly from the promotional effort of lumber retailers. Lumber, plywood, and wood-fiber boards are easily worked and can be used by the amateur more readily than metals or other alternative materials. It seems quite probable that this trend is in favor of the use of lumber and other timber products.

Many of the more drastic changes in demand for timber products are the result of shifts from one timber product to another--fiber shipping containers for wood boxes, plywood and wood-fiber boards for lumber, etc. While shifts of this kind are often unfavorable to certain sectors of the timber-products industry, they are not adverse to timber in general. Insofar as they represent a more efficient or more complete utilization of the basic raw material, they are economically desirable. Such trends are not of concern at this point.

Another change, not to be regarded as adverse to timber, is the reduction of demand due to improvements of the product itself. Preservation treatment has doubled and quadrupled the service-life of railroad cross ties, bridge and trestle timbers, poles, piling, and a number of other products. Improvements in the engineering design of various structures have also resulted in more economical use of wood. The roof-truss used in place of conventional rafters in house construction is a good illustration.

The trends that are truly adverse to use of timber products are those which involve substitution of some other material for wood or products of wood.

Lumber

The largest displacement of lumber, from the standpoint of volume, has been in the construction field by the mineral building materials--concrete, brick, cinder block, stone masonry, glass, and the like. With respect to large industrial, commercial, and public buildings, these materials in combination with steel have a dominant position. Wood and wood products are used only to a limited extent for doors, acoustic ceilings, and for some other minor purposes. In certain locations, buildings of this type do have wooden piling in the foundation structure. A considerable volume of lumber and plywood is used, however, during construction in concrete forms, scaffolding, chutes, temporary sidewalk sheds, and the like. Some of those materials are reused from one job to another. One major cause of the decline in the use of lumber in construction of large tall buildings is the necessity for reducing fire hazards to a minimum. That would not be possible in any large aggregation of wood materials. It is also true that the strength properties required to support such buildings are much greater than can be obtained in timbers of reasonable size. The steel beam is much superior for such uses.

In residential construction, the trends are somewhat confused. The past 20 years have witnessed a notable shift away from the large multiple-dwelling-unit structures toward the single-dwelling-unit house in a suburban location. This shift tends to move housing out of the field where steel and concrete have the advantage back into the field where wood and wood products can more readily compete with other materials. The rapid expansion of prefabricated housing, also favoring wood and wood products, has already been mentioned.

Brick and stone have been in competition with lumber for a long time. These two types of masonry construction, however, are handicapped by the amount of on-site labor that is required. Costs of such labor have been estimated to be as much as two-thirds of the cost of a masonry wall.11/ There is evidence that improved efficiency in the fabrication of lumber used in residential construction has so far tended to off-set the price advantages of brick. The construction-cost indexes for small residential structures published by E.H. Boeckh and Associates have shown no appreciable difference in the construction-cost trend for wood-frame structures and brick structures (table 7).

It is of interest in this connection to note (table 8) that single-family houses with solid brick or brick-faced masonry exterior-wall construction tend to be in the higher priced field. Concrete-block and the other nonbrick masonry has some foothold in the lower-price field, but they have not a very important hold anywhere in single-family dwellings. Conventional wood-frame exterior-wall construction is still the dominant type in all price classes (table 8).

The heavier inroads made by nonwood materials against lumber have been in the exterior covering of wood-frame structures. Of the single-family wood-frame houses started in the first quarter of 1954, wood was used as exterior-wall facing material on 38.4 percent (table 9), and wood in combination with brick on 5.6 percent. Brick was used as the facing material on 24.0 percent, asbestos shingles on 17.0 percent, and various other materials on 15.0 percent.

The houses faced with brick were more heavily concentrated in the selling-price range from $12,000 up. Those faced with asbestos shingles were concentrated in the selling-price range below $12,000. Houses faced with wood, on the other hand, were fairly evenly distributed through all price classes with a little more than half in the price range below $12,000.

Insofar as can be judged from these figures (table 9), asbestos shingles are a strong competitor with wood as facing material for low-price single-family housing. Brick or brick and wood in combination seem to have a moderate competitive advantage in houses selling for more than $12,000. It would seem that the preference for brick in these higher price brackets is due chiefly to factors other than cost of the installed material.

One architectural innovation that has reduced the lumber content of a certain amount of new housing is the use of the concrete slab instead of wall or pillar foundation. A sample survey of single-family detached houses built in various parts of the United States in 1950 showed that 4 percent of such houses were set on concrete slab.12/ It is certain

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11/ The President's Materials Policy Commission, RESOURCES FOR FREEDOM, Government Printing Office, Washington, D.C., Volume IV, Page 143.

12/ U.S. Housing and Home Finance Agency, THE MATERIALS USE SURVEY, Government Printing Office, Washington, D.C., 1953, Page 6.

Table 7.--Index of construction cost of small residential structures, 1915-53[1]

(1947-49 = 100.0)

Year	Frame structures	Brick structures	Year	Frame structures	Brick structures
1915	26.8	26.6	1935	39.5	41.1
1916	28.5	28.4	1936	40.9	42.5
1917	33.4	33.0	1937	45.9	47.3
1918	39.6	39.6	1938	47.0	49.0
1919	46.0	46.0	1939	48.1	49.7
1920	59.3	59.3	1940	49.8	51.1
1921	47.3	48.0	1941	54.3	54.9
1922	43.5	44.1	1942	57.4	57.8
1923	48.9	49.3	1943	60.1	60.5
1924	48.0	48.8	1944	65.5	65.4
1925	47.6	48.4	1945	70.1	70.1
1926	48.0	48.8	1946	76.8	77.1
1927	47.3	48.1	1947	93.4	92.9
1928	47.4	48.3	1948	105.1	104.4
1929	49.9	50.1	1949	101.5	102.7
1930	48.4	49.0	1950	107.6	108.1
1931	44.8	45.0	1951	115.5	116.6
1932	37.7	38.3	1952	118.2	119.9
1933	37.6	38.4	1953	120.0	122.3
1934	40.6	42.1			

1/ E.H. Boeckh and Associates' Index. Republished in U.S. Bureau of Labor Statistics, CONSTRUCTION COST INDEXES, Rpt. No. 73, p. 11, Washington, D. C., 1954.

Table 8.--New nonfarm dwelling units started in first quarter of 1954, as percent of total units started, by type of exterior-wall construction and selling price class

Selling-price class (dollars)	Total, all types	Wood-frame and other nonmasonry construction			Masonry construction			Type unknown
		Total	Wood frame 1/	Other including some pre-fabricated 1/	Total	Brick and brick facing	Concrete block and other	
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Under 7,000	10.6	9.7	8.5	1.2	0.9	0.2	0.7	(2/)
7,000 - 9,999	14.8	12.6	12.2	.4	2.2	1.2	1.0	(2/)
10,000 - 11,999	20.0	17.4	17.1	.3	2.4	1.6	.8	0.2
12,000 - 14,999	24.0	21.7	21.4	.3	2.1	1.7	.4	.2
15,000 - 19,999	16.5	12.7	12.5	.2	3.6	3.1	.5	.2
20,000 and over	9.7	7.4	7.1	.3	2.1	1.7	.4	.2
Price unknown	4.4	3.0	2.9	.1	.3	.1	.2	1.1
Total	100.0	84.5	81.7	2.8	13.6	9.6	4.0	1.9

1/ Prefabricated units of wall-panel construction are in both of these classes.
2/ Less than five-hundredths of 1 percent.

Source: U.S. Bureau of Labor Statistics, CHARACTERISTICS OF NEW HOUSING--FIRST QUARTER, 1954. Washington, D.C. Dec. 1954. (Mimeographed.)

Table 9.--New wood-frame nonfarm dwelling units started in first quarter of 1954, as percent of total units started, by kind of exterior wall-facing material and selling-price class

Selling-price class (dollars)	Total all materials	Facing material				
		Wood	Wood and brick	Brick	Asbestos shingle	Other
	Percent	Percent	Percent	Percent	Percent	Percent
Under 7,000	10.4	5.8	(1/)	0.1	4.3	0.2
7,000 - 9,999	14.9	7.3	0.1	1.5	4.5	1.5
10,000 - 11,999	20.9	8.7	.6	4.0	3.5	4.1
12,000 - 14,999	26.3	6.7	2.1	8.8	2.6	6.1
15,000 - 19,999	15.1	5.0	1.7	5.0	1.6	1.8
20,000 and over	8.9	3.4	1.0	3.5	.1	.9
Price unknown	3.5	1.5	.1	1.1	.4	.4
Total	100.0	38.4	5.6	24.0	17.0	15.0

1/ Less than five-hundredths of 1 percent.

Source: U.S. Bureau of Labor Statistics, CHARACTERISTICS OF NEW HOUSING--FIRST QUARTER OF 1954, Washington, D.C. Dec. 1954. (Mimeographed.)

that the percentage has risen substantially since 1950. The slab foundation, of course, eliminates girders, ground-floor joists, and possibly some sills. Slab foundation, however, is used under many of the prefabricated houses in which the superstructure is made almost wholly of wood and wood products. The net effect of any shift to slab-foundation design may prove to be less drastic upon demand for wood than has been expected.

While slab design has tended to favor asphalt tile, linoleum, or some similar type of floor covering, there is good reason to believe that the technical difficulties in placement of wood flooring on concrete can be overcome.

In conventional basement foundations, steel beams are being used extensively as girders under floor joists. Steel sash has largely displaced wood sash in basement windows. Steel casement is gaining some headway against wood sash in above-basement windows.[13]

For interior wall and ceiling finish, plaster-on-wood-lath has been almost displaced by gypsum board. Other definite trends towards displacement of wood include: aluminum-sash storm windows, aluminum screen doors, asphalt-tile kitchen floor covering, ceramic-tile bathroom floor covering and wainscoting, metal kitchen cabinets, metal basement doors. While none of these displacements of wood is very important by itself, the aggregate does amount to a considerable volume.

With regard to farm service-buildings and farm equipment, there are also some trends away from wood. These include the metal grain crib, the aluminum barn-roof covering, the concrete or tile or trench silo, metal and concrete water troughs, the electric fence, and a number of others. Farm machinery contains less wood than formerly. None of the shifts mentioned here is, by any means, complete but there has been enough to make some dent in the demand for wood.

With regard to railroad freight cars, there is a clear trend away from wood, and this includes about every type except livestock cars. Metal has also displaced wood in office furniture.

Other Displacements of Wood

Metal drums have displaced tight cooperage as containers for beer and many other liquids. But wood still holds the field as the only legal container for the ageing of whiskey.

Several factors have tended to diminish the consumption of wood in mining operations. Chief among these is the development of strip mining as a partial alternative to the underground mining of coal and metal ores. Round timbers used to support the roof of underground mines are being displaced, to some extent, by the newer techniques of bolting the roof to overlying strata of rock.

13/ See footnote 12, page 34.

Wood poles face competition by steel towers and by underground cables as carriers of electric power lines. But in this case the competition of materials is not so direct. Towers are used only for the heaviest of transmission lines. Cables are used most in places where overhead lines are not practicable. It is of interest to note that wood poles still carry a far greater mileage of power lines than is carried by towers and cables combined. The major private electric utilities in 1952 reported the following mileage of transmission and distribution lines:14/

	Miles	Percent
Wood pole, structure miles	1,077,025	89.3
Towers, structure miles	29,904	2.5
Underground and submarine cable, cable miles	99,071	8.2
Total	1,206,000	100.0

By far the largest actual displacement of wood from the standpoint of volume (but not from the standpoint of value) has been in the energy uses. Oil, coal, gas, and electric power have been the displacing agents. There is no indication that this kind of displacement is about to cease. The rural electrification program, for one thing, will accelerate the changeover from wood stoves to electric ranges in farm kitchens. It will also stimulate the installation of automatic oil heating systems in farm residences.

NET RESULT OF FAVORABLE AND ADVERSE FACTORS

The question naturally posed by the foregoing discussion is whether there has been a net displacement of timber products by other materials. But "net displacement" is a rather unmanageable concept. A more meaningful question would be whether the consumption of timber products (quantity-wise) has kept pace with the consumption of other materials of similar type.

Fuelwood

In trying to find the answer to this last question, it is desirable to consider fuelwood separately from all other timber products. Fuelwood is an energy material and its competitors are the other energy materials; all the other timber products belong in the physical-structure materials category.

Fuelwood consumption, as previously noted, has been declining. Consumption of other energy materials has been increasing at a very rapid rate. There can be no doubt about the fact that fuelwood has been displaced by other energy materials. But continuation of this trend will, however, have a minor effect upon the future timber-supply

14/ U.S. Federal Power Commission, STATISTICS OF ELECTRIC UTILITIES IN THE UNITED STATES, 1952. Washington, D.C., 1953.

situation. It has previously been noted that present cut of growing stock and of sawlog-size material for fuelwood is comparatively small.

Products Other than Fuelwood

With respect to total consumption of timber products other than fuelwood, the relevant comparison is against the consumption of nonwood physical material. Such a comparison over the years 1900 through 1952 is shown in table 10.

For every constant-dollar quantity unit of nonwood physical-structure material consumed in 1900, there was a parallel consumption of 6.48 cubic feet (roundwood basis) of timber products other than fuelwood. By 1930 that ratio had declined to 2.82 cubic feet per unit. Since 1930 there have been considerable up-and-down changes in the ratio but only a small net decrease. Those year-to-year changes are shown graphically in figure 7.

Returning now to the question of the net result of substitution trends, it appears quite certain that other physical-structure raw materials were displacing timber products in a rather drastic fashion over the period 1900 into the 1930's. However, a part of that observed lag in timber products consumption was due, not to displacement by other materials, but to improvements in the timber products themselves--improvements such as preservative treatment of railroad ties, engineering design that made a smaller piece of wood do the job formerly done by a larger piece, and reduction of material waste in fabrication processes.

In more recent times (1940's and 1950-1952), timber products appear to have held comparatively firm against the competition of other physical-structure materials. If there has been net displacement of timber, it has been to a rather mild extent. In other words, the losses sustained by lumber, cooperage, and other items have largely been offset by gains in use of other products such as paper, paperboard, nonpaper products of woodpulp and wood fiber, plywood, and the like.

Insofar as can be judged from the foregoing consideration of factors influencing the past consumption of timber products, there are no grounds for lack of confidence in the competitive position of timber against other materials. In spite of the fact that lumber, the major timber product, has lost ground to other timber products and to nonwood materials, the nonfuel demand for timber over the past twenty years has almost kept step with demand for the nonfuel materials that compete with timber.

Table 10.--Comparison of total consumption of timber products, other than fuelwood, with consumption of other physical-structure raw materials, 1900-52

Year	Timber products 1/	Other physical-structure materials 2/	Ratio 3/ col. 1 / col. 2	Year	Timber products 1/	Other physical-structure materials 2/	Ratio 3/ col. 1 / col. 2
	Million cu. ft.	Million units	Cu. ft. per unit		Million cu. ft.	Million units	Cu. ft. per unit
1900	8,782	1,355.8	6.48	1930	6,754	2,391.9	2.82
1901	8,891	1,273.3	6.98	1931	5,131	2,454.0	2.09
1902	9,030	1,695.8	5.32	1932	3,853	1,727.4	2.23
1903	9,054	1,525.7	5.93	1933	4,566	1,745.2	2.62
1904	9,010	1,769.8	5.09	1934	4,901	1,430.6	3.43
1905	9,134	1,707.2	5.35	1935	5,920	2,155.4	2.75
1906	9,640	1,849.3	5.21	1936	6,540	2,344.6	2.79
1907	9,825	1,642.4	5.98	1937	6,835	3,381.5	2.02
1908	8,912	1,684.2	5.29	1938	6,124	2,500.0	2.45
1909	9,534	1,840.2	5.18	1939	7,087	2,878.5	2.46
1910	9,484	1,977.8	4.80	1940	8,007	3,364.0	2.38
1911	9,083	1,886.8	4.81	1941	8,477	4,132.4	2.05
1912	9,421	1,985.4	4.75	1942	9,790	4,198.8	2.33
1913	9,310	1,870.0	4.98	1943	8,816	3,712.5	2.37
1914	8,711	2,182.7	3.99	1944	8,257	3,956.0	2.09
1915	8,452	1,890.3	4.47	1945	7,754	3,468.4	2.24
1916	8,936	2,110.3	4.23	1946	8,443	3,557.1	2.37
1917	8,320	2,397.2	3.47	1947	8,770	3,724.0	2.35
1918	7,694	2,241.5	3.43	1948	9,360	4,568.5	2.05
1919	8,009	2,019.1	3.97	1949	8,796	4,096.3	2.15
1920	8,199	2,558.8	3.20	1950	10,137	4,161.4	2.44
1921	6,945	1,553.5	4.47	1951	10,116	4,219.1	2.40
1922	8,023	1,941.3	4.13	1952	10,237	4,836.5	2.12
1923	8,923	2,465.9	3.62				
1924	8,598	2,362.9	3.64				
1925	8,787	2,603.5	3.38				
1926	8,677	2,717.2	3.19				
1927	8,221	2,413.1	3.41				
1928	8,509	2.662.5	3.20				
1929	8,095	2,754.5	2.94				

1/ Forest Service estimates, in terms of roundwood volume. Includes net imports of woodpulp and paper as equivalent volume of foundwood.

2/ In terms of constant-dollar quantity units. Estimates compiled by President's Materials Policy Commission. Revised and republished by U.S. Bureau of Census, RAW MATERIALS IN THE UNITED STATES ECONOMY, 1900-52. Washington, D.C., 1954.

3/ In terms of cubic feet of timber products per unit of other physical-structure materials.

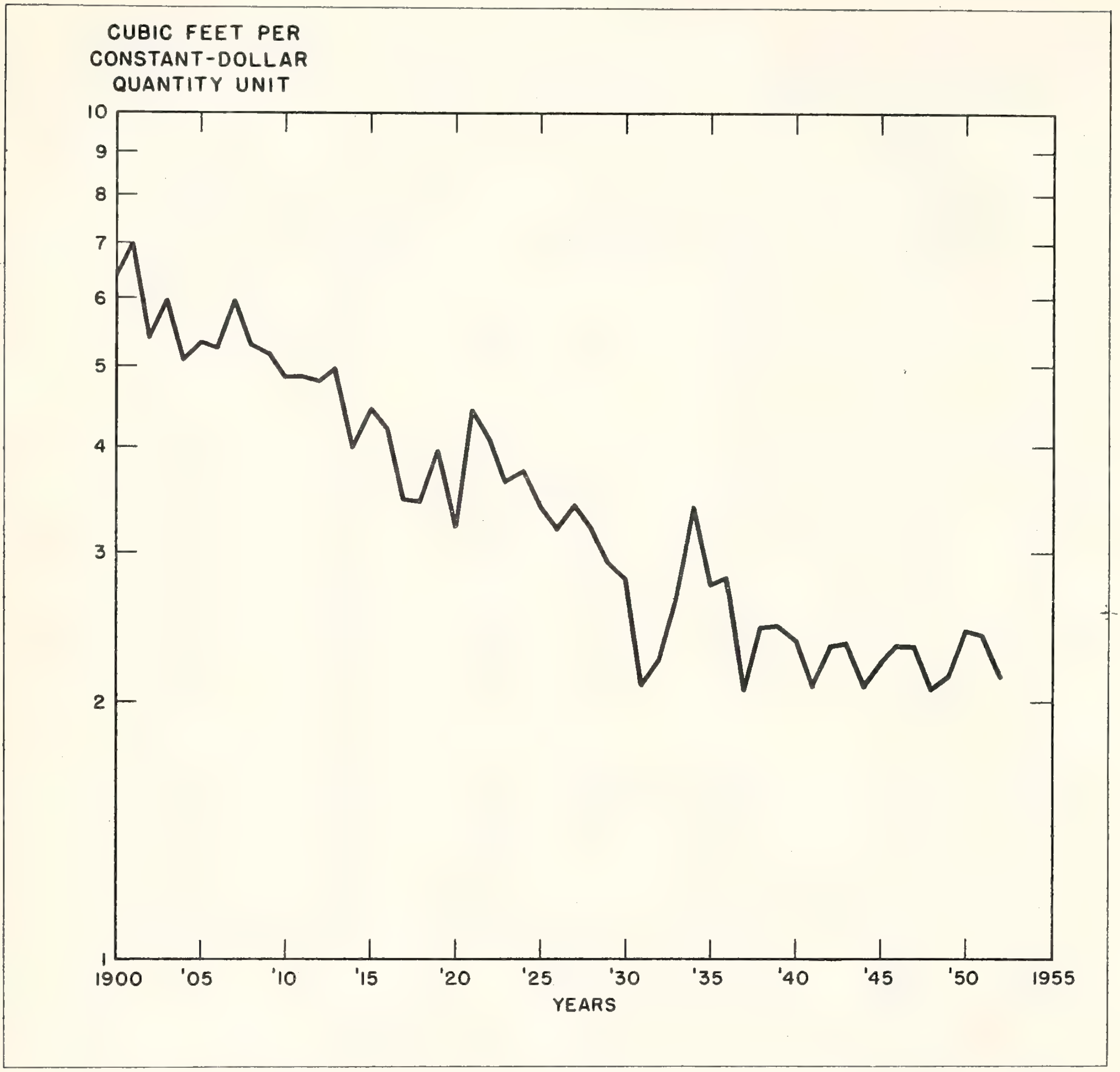

Fig. 7 - Changes in the ratio of consumption of all timber products (other than fuelwood) to consumption of all other physical-structure raw materials, 1900-52.

GENERAL SUMMARY AND CONCLUSIONS

The foregoing consideration of long-term and of recent aspects of timber-products consumption has led to several conclusions that will now be brought together in summary form:

1. The volume of timber products consumed in 1952, expressed in terms of the cubic-foot volume of logs and bolts, amounted to 12.2 billion cubic feet, or 78 cubic feet per capita.

Products other than fuelwood accounted for 83.6 percent of that total. Fuelwood accounted for 16.4 percent. Lumber and other sawed products accounted for 52.4 percent, pulpwood for 22.0 percent, veneer logs and bolts for 3.4 percent, and all other nonfuel products for 5.8 percent.

2. Timber products, over the past fifty years, have occupied a fairly important place in the raw-materials base of the Nation's economy. Comparison of the apparent annual consumption (weighted according to 1935-1939 value of each class of material) indicates that timber products used for nonfuel purposes comprised about one-third of the 1900 consumption of physical-structure material.[15/] From 1900 on into the 1930's, the fraction represented by timber shrank to a little more than one-sixth. Since the beginning of economic recovery in the 1930's, the timber-products fraction has expanded to about one-fifth. That halt and moderate reversal of the shrinkage trend has been due to a comparatively high consumption of lumber, to the long-term rapid increase of pulpwood-products consumption, and to more recent rapid increase in consumption of veneer and wood-fiber products.

The analysis indicates a decided firming of the competitive position of timber in the physical-structure materials field.

Fuelwood represented a major fraction of the energy materials consumed in 1900. By 1950-1952, it accounted for only a minor fraction. It seems most likely that the competitive position of wood as an energy material will continue to weaken.

3. Absolute consumption of timber products, other than fuelwood, increased moderately from 1900 to 1907, then declined rather steadily through 1921. In 1923 and 1924 there was a sharp upturn, followed by moderate decline through 1929. The Great Depression brought on a drastic reduction that continued through 1932. From 1933 through 1942 consumption increased to a point just under the 1907 peak. Wartime production difficulties resulted in a lowering of consumption in 1943 through 1945, but this was followed by an upswing that carried consumption to a 1950-1952 average that was 3.5 percent above the 1907 peak.

Since the beginning of economic recovery in the 1930's, the trend in consumption of nonfuel timber products has roughly paralleled the consumption trend of total physical-structure material.

15/ Materials other than foods, energy materials, and gold.

4. Comparison on the 1900-1952 index of average annual lumber price (adjusted to eliminate that part of its change attributable to changes in the commodity-purchasing power of the dollar) against a comparable lumber-consumption index (derived from the relationship of lumber consumption to total physical-structure-materials consumption) indicates that the long-term upward trend of lumber price has very evidently been one of the major factors that account for the failure of lumber consumption to keep pace with consumption of physical-structure materials in general. The analysis indicates that lumber demand was apparently more sensitive to price increases in the period from 1900 to the 1930's than it has been in the 1940's and in 1950-1952.

Comparison of similar indexes of price against consumption of products of pulpwood shows a rapidly increasing consumption against a relatively stable price trend.

The general inference drawn from the analysis is that should the real price of lumber, like that of pulpwood products, be held relatively constant, there is reasonable probability that lumber consumption would more nearly parallel the general upward trend of total physical-structure materials consumption.

5. The best information available indicates that not less than two billion dollars is being spent annually for the hauling of timber products from places of origin to points of final use. That sum of money is considerably more than is being paid for the basic raw material as it stands in the forests. In other words, more money is being spent to haul timber products from place to place than to grow timber.

The location of the more productive commercial forest lands, in relation to the areas of largest demand for timber products, is such that would, in the course of time, allow for a very substantial reduction of West-to-East and South-to-North transportation of timber products. Present trends in the shift of population from other parts of the country to the West, together with the growing industrialization of the West and the South, will automatically tend to increase demand for timber products in the West and in the South. The gradual attainment of a better balance between timber production and timber consumption in each of the major sections of the country would entail a substantial redistribution of the consumer dollar spent for timber products with a larger part of it going to the growers and processors of timber products.

6. A general survey of substitution trends favorable and adverse to timber products shows pulpwood and wood-fiber products in a strong competitive position. The same is true for plywood and other veneer products. New moisture-proof and moisture-resistant adhesives have greatly expanded the uses of plywood and opened the door for new and important uses for lumber in the form of various laminated products and "stressed skin" panels for prefabricated houses. Two of the other newer uses of lumber include decorative interior paneling, such as knotty pine, and pallets for the mechanical handling of goods in factories and in shipment. Use of lumber has also been stimulated by the do-it-yourself movement among home owners.

Shifts away from the use of timber products can be seen most readily with respect to lumber, but even here it is necessary to recognize that a large part of the displacement of lumber has been by other timber products such as plywood, paperboard, wood-fiber board, and the like. Such shifts are not a trend away from timber. Then too, some of the reduction in use of lumber has been the result of improvements in engineering design that make a smaller piece do the same job formerly done by a larger piece. Preservative treatment of railroad ties, bridge timbers, and the like, has greatly extended the service life of wood in those forms.

The actual displacement of lumber by nonwood materials has been most extensive in nonresidential construction and in multiple-family dwelling structures. In those fields, its use is now almost incidental. With regard to single-family dwellings, the displacement of lumber by nonwood materials has not been so extensive. Brick and stone in masonry-type exterior walls are still predominantly confined to the more expensive houses. Concrete-block masonry has gained a foothold in the field of low-price houses. For single-family houses, the wood-frame type of exterior wall structure is still dominant. But the story on exterior covering of wood-frame houses is much less favorable to lumber. Brick and asbestos shingles have strongly come into favor. Steel girders and pillars, asphalt-tile flooring, metal window frames, gypsum board, and various other materials have also displaced a considerable amount of lumber in single-family housing.

Some of the notable displacements of lumber outside the construction field have been in railroad freight cars, office furniture, and farm machinery.

Just how much of the displacement of lumber has been due to technological superiority of competing materials or other nonprice factors, and how much to the influence of rising price, can hardly be determined from the information now available.

Setting the substitution trends favorable to timber products, other than fuelwood, against the adverse trends, it appears on the basis of the data now available that timber lost heavily to other materials in the period 1900 to the 1930's. In the 1940's and 1950-1952, it seems to have just about held its ground against the nonwood materials.

With this background view of what has happened in timber-products consumption over the past fifty years, attention now turns to analysis of potential future requirements.

Regions and Sections used in the Timber Resource Review

TIMBER RESOURCE REVIEW

CHAPTER VI
FUTURE DOMESTIC REQUIREMENTS FOR TIMBER

(Preliminary Review Draft Subject To Revision)

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INDEX TO TIMBER RESOURCE REVIEW REPORTS AND APPENDIX MATERIAL

(Each Chapter and each Section, in the case of Chapters IV and IX, is a separate document)

CHAPTER VI. FUTURE DOMESTIC REQUIREMENTS FOR TIMBER

(Preliminary review draft subject to revision)

By:

James C. Rettie

September, 1955

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FUTURE DOMESTIC REQUIREMENTS
FOR TIMBER

INTRODUCTION

The purpose of this chapter is to present estimates of the quantity of timber that might, under reasonable assumptions, be used in the United States twenty and fifty years hence. Attempts to look that far into the future, of course, entail much uncertainty about almost every factor to be considered. Nevertheless, it is impossible to escape the fact that the growing of commercial timber from seedling to merchantable tree is an enterprise that extends from twenty to a hundred years or more. Forest management inevitably involves the planning of operations over long periods of time.

Estimates of long-term timber requirements (or potential demand for timber products under the assumed conditions) are not to be regarded as forecasts of actual future consumption of timber products. They more nearly resemble the potential-demand estimates that a large manufacturing concern might make from time to time. Such estimates are one of the guidelines used by the producer in making advantageous decisions about when, and how much to expand his production facilities. The best possible forecast of future consumption of the commodity in which he is interested would be of limited value in making those decisions, because its validity would depend, to a large extent, upon the forecaster's hunch as to what the producers of that commodity would actually do or not do about increasing the supply. There is not much point in producers trying to forecast what they themselves are likely to do with regard to supply until they have the best estimate they can obtain of the quantity of product that customers might be willing and able to buy at specified future dates.

With respect to the timber-growing enterprise, there is a somewhat analagous situation. Much has been done in the past to alter the forward outlook for timber supply. Much more can be done to alter it still further. Decisions as to what should be done in this matter depend partly on what the long-term potential demand for timber products might be if supply were sufficient.

To illustrate, one has only to look back fifty years and ask: "What forecast of 1952 consumption would have been realistic in 1900, considering the prospective future supply of timber as of that date?" The forest-fire protection system, as we now know it, was practically non-existent. Virtually nothing was known or being done about forest-pest protection. Management of forest lands on a timber-cropping basis was almost unheard of. If the last fifty years of effort along such lines had not been made by persons and organizations bent on improving the supply, consumption of timber products in 1952 would probably have been far below what it was.

If potential demand during the next fifty years promises to outrun the timber supply now in prospect, it is entirely reasonable to expect new developments in forestry that will alter the supply outlook in the future, as it has been altered during the past fifty years. Any realistic appraisal of future supply possibilities in our technically advanced economy should rely quite heavily on appraisal of potential demand.

For any enterprise as economically important as the production and utilization of timber products, supply plays some role in the generation of its own demand; and demand certainly exerts an influence upon supply. In the case of timber, however, response on the supply side cannot become very effective in one year, nor in ten. This fact emphasizes the need for a clear anticipation of what the long-term potential demand for timber products might be.

Timber requirement estimates serve as an indication of the general magnitude of future demand under a specified set of reasonable assumptions. Such indicators are only one of the considerations involved in reaching decisions on the question of how much timber the Nation should plan to grow for the future.

Their immediate use is to provide a framework for analysis of future supply possibilities. The apparent ease or difficulty of economically developing a supply commensurate with potential future demand provides, among other things, some clue as to what the future trend of timber prices is likely to be. Potential demand higher than prospective supply indicates the probability of an upward movement of timber price. But higher and higher real price for one of the Nation's basic raw materials would not be conducive to continuing improvement in the general standard of living.

One function of forest policy, and of resource policy in general, is to anticipate raw-material supply problems and to devise such ways and means as may be practicable to solve, or at least alleviate them before they become too critical.

THE UNDERLYING ASSUMPTIONS IN BRIEF

Estimates of the potential demand for timber products--or for any other commodity--could hardly be made without explicit assumptions regarding those factors that would determine demand at the future date for which the estimates are desired. The formulation of whatever assumptions are used is obviously just as important as any other part of the estimating task. Furthermore, the final estimates can be no better than the assumptions upon which they rest. It is, accordingly, not fair to expect that assumptions be accepted with no explanation of how they were formulated. The main purpose of this section is to offer that explanation.

Knowing, however, that many readers have had no reason to familiarize themselves with the procedures used in making projections of future population, gross national product (output of all goods and services), intake of raw materials, demand for residential and other types of construction, and other factors; it is desirable to summarize the basic assumptions at this point before proceeding to explain how they were arrived at. For any reader who may not want to review the rather detailed explanation, this summary may be sufficient. He has a choice of passing from the summary of assumptions over to the more specific analysis of demand for timber products, if he prefers to do that. The offer of this alternative, however, is not intended to minimize the importance of the formulation of basic assumptions.

It has been assumed for purposes of the present study that the population of the United States in 1975 will be 210 million, and in the year 2000 it will be 275 million. The 1975 figure lies about midway between the Census Bureau's two "medium" projections for that year. The year-2000 figure lies about midway between the highest and the lowest estimates that are obtainable by extending the Census Bureau's 1975 projections. Insofar as can be judged from indications up to July 1955, these population assumptions appear to be quite conservative.

If population increases to 210 million by 1975 and to 275 million by 2000, it is very probable that the number of households (principally families) will increase from 46.9 million in 1954 to 65.0 million by 1975 and to 91.0 million by 2000.

It has been assumed that the United States will continue its role as a leading member of the free world nations, and that this will require maintenance of armed forces at about their 1953 strength in terms of manpower. It has further been assumed that international tensions will not subside entirely, but that war will be avoided.

Another important assumption is that private and public policy will succeed in holding unemployment to an average level of somewhat less than 4 percent of the civilian labor force. This would not provide full employment but it would be high-level employment.

Subtracting military personnel and a moderate number of unemployed from the total labor force that would exist in populations of 210 and 275 million, indicates that the employed civilian labor force might be about 78 million in 1975; in 2000 it might be about 100 million.

It has been assumed that the work-week, which averaged 40.2 hours in 1953, will decrease to about 35.0 by 1975 and to 32.0 by 2000. This would be the result of some decrease in average hours per day and also of the growing practice of companies to provide their employees an annual vacation with pay.

Average productivity per man-hour has been increasing during the period 1940-53 at the average rate of about 2.5 percent per year. It is likely that productivity will continue to maintain something like its recent rate of increase. The rate of increase assumed in this study for the 1953-75 period is 2.4 percent per year. For the period 1953-2000, it has been assumed that productivity will increase, on the average, at the rate of 2.1 percent annually. Both of these assumed rates of future man-hour productivity increase are lower than some recent studies of the matter might justify.

On the basis of the factors that have now been discussed, the total national output of all goods and services (gross national product) would be expected to increase by about 100 percent during the period 1950-75. This involves an increase from $320.1 billion in 1950 (and $364.9 billion in 1953) to about $630.0 billion by 1975. All of these dollar figures are in terms of 1953 prices. On the same basis, gross national product by 2000 would be about $1,200 billion, which implies an increase of 90 percent during the period 1975-2000. While such figures do tend to stagger the imagination of most of us, they are no more than conservative projections of the economic progress achieved by the economy of the United States during the past fifty years.

With gross national product at $630 billion in 1975 and at $1,200 billion in 2000, disposable personal income (personal income after taxes) would be expected to rise from its 1953 level of $250 billion to $433 billion by 1975 and to $826 billion by 2000. In terms of per capita average, the increase would be from $1,567 in 1953, to $2,062 in 1975, and to $3,004 in 2000. This implies an increase of about 30 percent for the period 1953-75 and about 90 percent for the longer period 1953-2000. Here again, the projected increases are about the same as have been achieved during the past fifty years.

On the basis of the available information about the annual intake (consumption) of raw materials by the Nation's economy during the period 1900-52, it appears that raw-material requirements have been increasing considerably faster than growth of population. This, of course, is a reflection of the rise in standards of living. If those standards are to continue to improve as they have in the past, the intake of raw materials, on a per capita average basis, will also have to continue to increase. It has, therefore, been assumed that the increase (on a per capita basis) during the next fifty years will be of about the same magnitude that it has been during the past half century. The increase assumed for the future is as follows:

	Projected increase of intake	
	Per capita intake	Total intake
	Percent	Percent
Foods[1]		
1950-75	5	48
1950-2000	10	100
Energy materials[2]		
1950-75	26	75
1950-2000	66	200
Physical-structure materials[3]		
1950-75	13.5	60
1950-2000	27.5	135

[1] Includes fishery products as well as those of agriculture.
[2] Includes all the mineral fuels and the wood used for fuel.
[3] Includes all the nonfuel minerals, the timber products other than wood used for fuel, and the nonfood products of agriculture.

The large increase of population foreseen during the next forty-five years will certainly entail an increase in the Nation's inventory of housing. In addition to that housing needed to accommodate the expected net increase of families and other households, there will be a continuing need to replace housing lost by fire, flood, and other causes; to replace obsolescent, substandard, and otherwise unusable housing; and to maintain a considerable margin of seasonal housing and of temporarily unoccupied dwelling units.

Analyzing the housing requirements, both from the standpoint of population and of probable demand, indicates that average number of new (nonfarm and farm) dwelling units demanded annually in specified future years may be about as follows:

Year	Thousand dwelling units
1960	1,300
1965	1,600
1970	1,900
1975	2,200
2000	2,400

Nonresidential construction normally absorbs a considerable volume of lumber and other timber products. Activity of this type will therefore have a bearing on the future demand for timber. Because of the very wide range of projects that come under the heading of nonresidential construction (industrial, commercial, institutional, educational, and governmental buildings; public utilities, highways, military facilities, and public works) the only practicable measurement of physical output is dollar expenditure in putting such facilities into place. Expenditure estimates are adjusted by use of construction-cost indexes to provide a rough indication of the physical volume of such construction.

Over the period 1915-54, the output of residential construction, in terms of constant dollars, has represented about 5.8 percent of gross national product. It has been assumed that the 1975 expenditures for new nonresidential construction, not including that done by railroads and on farms, will represent 5.6 percent of gross national product and that year-2000 expenditures will represent 5.0 percent. The estimated 1954 expenditure and the assumed future expenditures are as follows:

Year	Billion dollars
1954	21.3
1975	35.0
2000	60.0

The assumptions set forth in the two paragraphs above apply only to new (residential and nonresidential) construction. Maintenance and repair, including alteration and additions to residential structures, are an important part of the market for timber products. The estimate of 1953 activity along that line in terms of expenditure and the assumed future expenditures are as follows:

Year	Billion dollars	
	Residential	Nonresidential
1953	6.6	6.6
1975	9.3	11.2
2000	13.0	19.2

The various figures cited above, and brought together in table 1, provide the general framework of assumption in which the estimates of potential demand for timber products have been made.

In the course of the demand analysis, it has been necessary to employ some further assumptions regarding price and a number of other matters. But for the sake of convenience to readers, those assumptions have been put into context with the discussion of timber products rather than in this section which deals entirely with more general economic factors.

If the reader is not disposed to give detailed consideration to the evidence on which the general assumptions are based and to the procedures used in their formulation, he may now want to pass over to page 40 for the opening summary of the analysis of potential demand for timber products.

TABLE 1.--Summary of basic assumptions regarding growth of the Nation's economy up to 1975 and 2000

Item		Recent estimate		Projections	
		Year	Amount	1975	2000
Total civilian population in continental United States	million persons	1955	165.0	210.0	275.0
Number of households in the population	million	1954	46.9	65.0	91.0
Employed civilian labor force	do	1953	61.9	78.0	100.0
Average work-week[1]	hours	1953	40.2	35.0	32.0
Average annual increase of man-hour productivity	percent	1940-53	2.5	2.4	2.1
Man-hour productivity at 1953 prices	dollars per hour	1940-53	2.5	4.4	7.2
Gross national product[2]	billion 1953 dollars	1953	364.9	630.0	1,200.0
Disposable personal income[3]	do	1953	250.1	433.0	826.0
Per capita disposable income	do	1953	1,567.0	2,062.0	3,004.0
Intake of new raw materials, physical-volume index:					
Foods[4]	1950 - 100	1952	104.0	148.0	200.0
Energy materials[5]	do	1952	106.0	175.0	300.0
Physical-structure materials[6]	do	1952	115.0	160.0	235.0
Per capita basis, intake of new raw materials, physical-volume index:					
Foods	1950 - 100	1952	--	105.0	110.0
Energy materials	do	1952	--	126.0	166.0
Physical-structure materials	do	1952	--	113.5	127.5
Nation's housing inventory, dwelling units[7]	thousand	1954	[8] 50,897.0	70,200.0	98,280.0
Average annual requirement for new housing, dwelling units	do	--	--	2,200.0	2,400.0
Annual expenditure, nonresidential construction[9]	million 1953 dollars	1954	21,300.0	35,000.0	60,000.0
Annual expenditure for maintenance and repair:					
Residential, including alterations and additions	million 1953 dollars	1953	6,600.0	9,300.0	13,000.0
Nonresidential[9]	do	1953	6,600.0	11,200.0	19,200.0

[1] Year-long average, adjusted for holidays and other time away from the job.
[2] Total output of all goods and services at 1953 prices.
[3] Personal income less direct taxes.
[4] Includes fishery food products as well as those of agriculture.
[5] Includes coal, petroleum, natural gas, and fuelwood.
[6] All material other than foods, energy materials, and gold.
[7] Farm as well as nonfarm. Occupied and unoccupied dwelling units.
[8] Census Bureau estimate of occupied dwelling units, with allowance of 8.0 percent unoccupied.
[9] Excludes railroad and farm nonresidential construction.

FORMULATION OF THE UNDERLYING ASSUMPTIONS

Prognostications as to the probable size of the Nation's population and of the national economy ten to twenty years in the future have been made by a number of agencies.[1] The population and gross national product assumptions used in the present study, insofar as 1975 is concerned, are generally in line with the projections made by other agencies. With respect to the year 2000, it has been necessary to make an independent projection because no other agency has extended its estimates that far into the future.

THE POPULATION OUTLOOK FOR 1975 AND 2000

The unexpected upsurge in the birthrate that occurred in the early 1940's, continuing during the post-war years up to the time of present writing, has made a shambles of population forecasts generally accepted from ten to twenty years ago.[2] Instead of the leveling-off expected to begin about 1965, there is strong probability that the period 1960-75 will witness another surge of births when persons born after 1940 will be having families of their own. This double-infusion of younger-age persons into the population structure will almost certainly keep the Nation's population on the upward trend until the year 2000 and beyond.

Taking the factors of the new situation into account, the Bureau of the Census has published[3] four projections of the United States population to 1975, based on various assumptions as to future fertility rates. From lowest to highest, these projections (rounded to the nearest million) are: 199, 207, 214, and 221 million.

The figure 210 million used as the 1975 population assumption in this study is approximately midway between the Census Bureau's two middle projections.

Further extensions of the Bureau's 1975 projections, based on the same fertility-rate assumptions, indicate a minimum population of 240 million and a maximum of 320 million in the year 2000.

The figure 275 million used as the 2000 population assumption in this study is somewhat below the mid-point between the lowest and the highest extensions.

The 1975 assumption (210 million) implies an average annual rate of net population increase during the period 1954-75 of 1.27 percent. The 2000 assumption (275 million) implies a rate of 1.16 percent for the period 1955-2000 (table 2).

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[1]U. S. Bureau of the Census, ILLUSTRATIVE PROJECTIONS OF THE POPULATION OF THE UNITED STATES, 1955-1975, Current Population Reports, Population Estimates, Series P-25, No. 78. Washington, D. C. 1953.

Staff of the Joint Committee on the Economic Report, U. S. Congress, POTENTIAL ECONOMIC GROWTH OF THE UNITED STATES DURING THE NEXT DECADE, Committee Print, Government Printing Office, Washington, D. C. 1954.

The President's Materials Policy Commission, RESOURCES FOR FREEDOM, Vols. I - V. Government Printing Office, Washington, D. C. 1952.

Stanford Research Institute, AMERICA'S DEMAND FOR WOOD, 1929-1975, Weyerhaeuser Timber Company, Tacoma, Washington. 1954.

National Bureau of Economic Research, LONG-RANGE ECONOMIC PROJECTION. Princeton University Press, Princeton, N. J. 1954.

Colm, Gerhard, and Young, Marilyn, THE AMERICAN ECONOMY IN 1960, National Planning Association, Washington, D. C. 1952.

Owen, Wilfred, A MID-CENTURY LOOK AT RESOURCES, The Brookings Institution, Washington, D. C. 1954.

[2]See, for example, Davis, Joseph S., THE POPULATION UPSURGE IN THE UNITED STATES, Food Research Institute, Stanford University, Palo Alto, Calif. 1949.

[3]First reference in footnote 1.

The drastic change in population outlook from what it was at the time of the 1946 Forest Service study of the Nation's timber situation can hardly be over-emphasized. Instead of the expectation that population would reach stability at the 170 to 185 million level[4] by the year 2000, it is now relatively certain that such levels will be exceeded by about 100 million--even on the basis of present middle-ground expectations.

It is now clear that the demands on the Nation's supply of the basic raw materials will be much higher than was foreseen only ten years ago. The revised population outlook, of course, has an obvious bearing on all programs for resource development and conservation.

TABLE 2.--Population of the United States at the beginning and at the end of specified periods 1800-1953, and average annual rate of net increase for the period; projections of the population for specified period 1954-2000 implied average annual rate of net increase for such periods

Census and projection years	Population			Average annual rate of net increase
	At the beginning of period	At the end of period	Increase during period	
Census count:	*Thousands*	*Thousands*	*Thousands*	*Percent*
1800-50	5,308	23,192	17,884	2.99
1850-1900	23,192	76,094	52,902	2.40
1900-30	76,094	123,077	46,983	1.61
1930-40	123,077	132,122	9,045	0.71
1940-50	132,122	151,677	19,555	1.39
Census estimates:				
1950-53	[1]150,552	[2]161,100	10,548	2.27
Projections:				
1954-75:				
Series A	161,100	221,000	59,900	1.52
Series B	161,100	213,600	52,500	1.35
Series C	161,100	206,600	45,500	1.19
Series D	161,100	198,600	37,500	1.00
Midway B and C	161,100	210,100	49,000	1.27
1955-2000:				
Series A	[3]163,800	320,000	156,200	1.50
Series B	163,800	275,000	111,200	1,16
Series C	163,800	250,000	86,200	0.94
Series D	163,800	240,000	76,200	0.85

[1]Census Bureau estimate of population as of Jan. 1, 1950.
[2]Census Bureau estimate of population as of Jan. 1, 1954.
[3]Estimate for Jan. 1, 1954, adjusted to Jan. 1, 1955 on basis of Census Bureau estimate of Jan. 1, to March 1, 1954 increase.

Source: Data for 1800-1900, HISTORICAL STATISTICS OF THE UNITED STATES; 1900-50, STATISTICAL ABSTRACT OF THE UNITED STATES, 1953.
Projections, 1954-75, Bureau of the Census, Current Population Reports, Series P-25, No. 78.
Projections, 1955-2000, Extensions of the Census Bureau's projections for 1975.

[4] The Census Bureau's estimate of the population as of June, 1955 was 165 million.

POTENTIAL OUTPUT OF ALL GOODS AND SERVICES, 1975 AND 2000

The second group of assumptions used in this study has to do with the potential total output, or gross national product, of the Nation's economy in 1975 and 2000. These projected levels of economic output are expressed in terms of 1953 constant dollars.

Projection of gross national product to some future date involves consideration of population factors and productivity factors.

The population factors include: (1) total population, (2) labor force, (3) armed forces, (4) civilian labor force, (5) unemployed civilian labor force, and (6) employed civilian labor force.

The productivity factors taken into account in making gross national product projections include: (1) average hours per week, adjusted for holidays, vacations, etc.; (2) total hours of employment per year; (3) average man-hour productivity in constant dollars; and (4) average rate of annual increase of man-hour productivity.

Projections arrived at by this method are, of course, contingent upon the underlying assumptions that may or may not be realized. This point is well stated by the staff of the Joint Committee on the Economic Report in connection with its own gross national product projection for 1965:[5]

> A vast literature is being built up on the techniques and uses of economic 'forecasting'. ... 'Forecasting' is, in a sense, an unfortunate word. While perhaps describing the work of many private and business economists, it does not adequately describe the work of most Government economists. Public endeavors, and many private ones as well, are projections into the future based on a clearly defined set of stated assumptions.
>
> They should not be called predictions or forecasts because their very existence, indeed the very fact that they are being made, may put in motion forces which lead to changes in programs, and hence in the assumptions. A projection, for example, on the basis of present trends, plans, and expectations showing a deflationary tendency for the next year conceivably might result in public or private program changes which would have the effect of preventing or softening the decline implied in the original projection. If this happened the economist or agency making the projection ought not to be accused ex post of having been a poor 'forecaster'.

These qualifying comments, of course, do not imply that long-range gross national product projections are a mere academic exercise. They are attempts to delineate the general features of the Nation's future economy on the basis of what is known about past growth; and they should be as realistic as it is possible to make them.

The Population Factors

Using the past relationship of labor force to population 15 years of age and older, but making some allowance for longer attendance in school by young people and earlier retirement by older people, the indications are that the Nation's labor force by 1975 will number 85 million. This estimate is fairly reliable for the reason that most of the people who will be in the 1975 labor force have already been born. With regard to the year 2000, a labor-force projection consistent with the population assumption used in this study would be about 108 million.

Assuming that international tensions will not relax entirely in the near future, that the United States will have to maintain about its present military strength in terms of

[5] Staff of the Joint Committee on the Economic Report, POTENTIAL ECONOMIC GROWTH OF THE UNITED STATES DURING THE NEXT DECADE. U. S. Congress, Committee Print, 1954, p. 1.

manpower, but that actual war will be avoided; the armed forces in 1975 would contain about 3.5 million persons and in 2000 about 4.0 million. Such figures imply that the armed forces will require a decreasing percentage of the labor force.

Another basic assumption of the present study is that the Nation's economy will continue to function at a high level of employment. "High-level" employment implies that unemployment will be held down to a level of from 3 to 4 percent of the labor force. If such were done, the average unemployment in 1975 would not exceed 3.5 million and that of 2000 would not amount to much more than 4 million.

Making these deductions for armed forces personnel and for a minimum level of unemployment the employed civilian labor force in 1975 would number 78.0 million, and in 2000 it would contain 100 million.

Man-hour productivity estimates are available only for the private sector of the economy. The private sector also includes all producers of goods and services sold to Government, but it does not include the employment in general civilian governmental service. The amount of employment in general Government service (Federal, State, and local) to be expected in 1975 and 2000 depends on the will of the citizenry for either more or less Government service. With no clear evidence that any great changes in that respect are in the making, it has been assumed that such employment will remain at the present level of about 10 percent of the employed civilian labor force. Employment in the private sector of the economy in 1975 is estimated at 70.65 million, and in 2000 at 90 million.

The various steps described above are now summarized as follows:

	Million persons	
	1975	2000
Total population	210.0	275.0
Total labor force	85.0	108.0
Armed forces	3.5	4.0
Civilian labor force	81.5	104.0
Unemployed	3.5	4.0
Employed civilian labor force	78.0	100.0
Private sector	70.65	90.0
Government sector	7.35	10.0

The Productivity Factors

Average work-week and work-year

The average work-week in private employment has decreased from about 48 hours in 1929 to about 40 hours in 1953. The trend toward general adoption of the 40-hour week and the growing practice to provide employees an annual vacation with pay indicates that the average work-week will shorten still further.

It has been assumed that by 1975 the 40-hour week will have become almost universal. There is not much doubt that the seven conventional holidays will still be observed. If annual vacations average 15 days and sick leave or other lost time averages 10 days, the average work-year would be approximately 1,820 hours or 35 hours per week. Such a figure appears reasonable for 1975. By 2000, it might be down to 32 hours per week or 1,664 hours per year.

Productivity per man-hour

Productivity per man-hour is the most crucial of all factors used in making gross national product projections. Unfortunately, it is the one about which least is known and about which judgements differ.

The concept of a productivity measurement includes changing efficiency in the use of all three factors of production: (1) land, or in the broad sense natural resources; (2) capital, in the form of plant and equipment and working stocks; and (3) the human labor force.

Productivity measurements have usually been expressed in terms of output in relation to man-hour input of labor. This can be somewhat misleading because the man-hour productivity index actually includes efficiency changes in the use of land and capital as well as changes in the efficiency of labor.[6] The all-inclusive nature of the concept should be kept in mind.

A rapid and sustained increase in productivity of land, capital, and labor, fitted together in technically organized economic enterprise, began with the industrial revolution. This upsurge of output embraces a comparatively short and unique period of human history. That productive efficiency could continue to increase indefinitely on a compound interest curve is hardly conceivable. What seems more likely is that it will follow the logistic curve in which the rate of increase rises: First, on a gentle gradient that gradually becomes steeper and then gradually levels off to a gentle gradient again.

But even granting the reasonableness of the logistic-curve hypothesis, there is still the problem of locating our present position on such a curve. Persons who have firm confidence that technology will maintain the flow of new discoveries tend to fix our present position well down on the steep segment of the curve. Others, who are not so confident, tend to fix it higher--where the rate of increase begins to level off. About all that can be said, on the basis of present evidence, is that definite signs of a leveling-off tendency have not as yet appeared.

Differences in judgement as to what the future average annual rate of increase in man-hour productivity might be are illustrated in several recent gross national product projections.

Colm,[7] noting that man-hour productivity of privately employed persons had risen at an average annual rate of 2.7 percent during recent years, assumed an increase of 2.5 percent during the 1950-60 decade. The President's Materials Policy Commission[8] likewise assumed an increase of 2.5 percent during the period 1950-75. The Staff of the Joint Committee on the Economic Report,[9] in its gross national product projection for 1965, has assumed a rate of about 2.8 percent for the period 1953-65.

The Stanford Research Institute projection of gross national product to 1975,[10] on the other hand, implies a much lower average annual rate of increase---1.42 percent for the period 1952-75. The reasons for making a projection that implies a man-hour productivity increase so much lower than has been anticipated by other agencies, and so much lower than has prevailed over the past forty years are not explained in the Institute's report.

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[6]Kendrick, John W., "National Productivity and its Long-Term Projection," in National Bureau of Economic Research, LONG-RANGE ECONOMIC PROJECTION, Princeton University Press, Princeton, N. J. 1954. pp. 67-104.

[7]Colm, Gerhard, THE AMERICAN ECONOMY IN 1960, National Planning Association, Washington, D. C. 1952. p. 19.

[8]The President's Materials Policy Commission, RESOURCES FOR FREEDOM, Government Printing Office, Washington, D. C. 1952. Vol. II, p. 111.

[9]Staff of the Joint Committee on the Economic Report, POTENTIAL ECONOMIC GROWTH OF THE UNITED STATES DURING THE NEXT DECADE. U. S. Congress, Committee Print, Government Printing Office, Washington, D. C. 1952. (Percentage derived from dollar figures given in table 1, p. 19.)

[10] Stanford Research Institute, AMERICA'S DEMAND FOR WOOD, 1929-1975, Weyerhaeuser Timber Co., Tacoma, Washington, 1954. (Derived from dollar figures given in table 1, p. 12.)

The results of one recent study of man-hour productivity in private employment as a whole are summarized in table 3. The dollar figures used to express "real product" are all in terms of 1953 prices.

Comparing the 1910-14 average ($1.11) against the 1949-53 average ($2.49) shows that man-hour productivity has been increasing, over the period as a whole, at the rate of 2.07 percent per year. This long-term average rate of increase is, however, a bit misleading because the average percentage increase during the latter part of the period has been considerably higher than in the earlier part. The average annual rate of increase in the period 1940-53, for example, has been a little more than 2.5 percent.

For purposes of the present study, it has been assumed that productivity per man-hour in private employment will increase, from the 1949-53 average of $2.49, to $4.42 by 1975, and to $7.22 by the year 2000. Such estimates imply an average annual increase of about 2.4 percent during the period 1950-75 and of about 2.1 percent during the longer period 1950-2000.

Gross National Product Projections, 1975 and 2000

Using the various population and productivity factors that have now been discussed, the computations of private gross national product and of total gross national product are as shown in table 4. Total gross national product is derived from the estimate of private gross national product by assuming that output from the private sector of the economy will be 90 percent of the total.

According to these assumptions and this method of projection, the gross national product of the United States by 1975 would be $630 billion, and by 2000 it would be $1,200 billion. Both figures are in terms of 1953 constant dollars. The percentage increase during the period of 1950-75 would be approximately 100 percent; that for the period 1975-2000 would be approximately 90 percent.

TABLE 3.--Real product per man-hour in private employment, 1910-53

[At 1953 prices]

Year	Dollars	Year	Dollars	Year	Dollars
1910	1.06	1925	1.44	1940	1.91
1911	1.07	1926	1.46	1941	2.01
1912	1.15	1927	1.46	1942	2.01
1913	1.12	1928	1.46	1943	2.03
1914	1.13	1929	1.49	1944	2.17
1915	1.12	1930	1.44	1945	2.24
1916	1.13	1931	1.48	1946	2.15
1917	1.11	1932	1.42	1947	2.13
1918	1.11	1933	1.38	1948	2.23
1919	1.21	1934	1.51	1949	2.30
1920	1.21	1935	1.62	1950	2.47
1921	1.19	1936	1.67	1951	2.49
1922	1.28	1937	1.72	1952	2.56
1923	1.35	1938	1.76	1953	2.64
1924	1.37	1939	1.82		

Source: Joint Committee on the Economic Report, POTENTIAL ECONOMIC GROWTH OF THE UNITED STATES, p. 34, U. S. Government Printing Office. 1954.

TABLE 4.--Computation of gross national product on the basis of specified assumptions, 1975 and 2000

Assumption		1975	2000
Average work-week	hours	35	32
Average work-year	do	1,820	1,664
Private employment	million man-years	70,650	90,000
Private employment	billion man-hours	128,583	149,760
Product per man-hour	1953 dollars	4.42	7.22
Private gross national product	billion 1953 dollars	568	1,080
Total gross national product[1]	do	630	1,200

[1]Assuming that 90 percent of total gross national product would come from the private sector of the economy.

Disposable Personal Income

Demand for consumer goods in 1975 and 2000 will depend on how much personal income people will have to spend. The usual measure of such purchasing power is called "disposable personal income," or total personal income after payment of direct taxes. If the relationship of disposable personal income to gross national product in 1975 and in 2000 should be about as it was in 1953, such income would increase as follows:

Year	Billion dollars	Per capita dollars
1953	250.1	1,567
1975	433.0	2,062
2000	826.0	3,004

The 1953-75 percentage increase in per capita disposable income would be about 30 percent and the 1953-2000 increase would be about 90 percent. This, of course, would imply a very substantial increase of per capita consumer demand for goods and services of all kinds.

The Raw Materials Consumption Outlook, 1975 and 2000

The volume of raw materials that will be necessary to sustain the Nation's economy in 1975 and in 2000 (with population at 210 and 275 million respectively) will certainly be much larger than at present consumption. Maintenance of the existing per capita consumption would alone require that the 1950 raw-materials intake be stepped up 38 percent by 1975 and 81 percent by 2000.

Moderate advancement in the general standard of living is possible, however, without increase of per capita raw-materials consumption. Such advancement has progressively been attained by: (1) elimination of waste, (2) changes in design which call for less raw material per unit of ultimate product, (3) substitutions that exchange a less durable material for one more durable, and (4) use of "scrap" recovered from obsolete or worn-out goods. All of these technological economies are important. But future improvement in the standard of living would be much slower than in the past if the economy were to become dependent on these alone.

What seems more likely to happen is that improving technological efficiency in the utilization of basic raw material will, as in the past, be supplemented by further increases in per capita consumption. There is ample reason to believe that past trends of

increasing per capita consumption of food, energy material, and physical-structure material will continue--at least, for the next generation or two.

Future Requirements for Food

Future requirements for food are not of major concern in this study. There is, however, some competition between the use of certain lands for timber production and use for production of crops and forage. The apparent necessity for a fairly large increase in food production during the next fifty years does have some bearing on the amount of land that may be available for the growing of commercial timber.

There has been an apparent long-term increase of about 10 percent in per capita consumption of food during the 42-year period 1910-52. If there should be a further comparable long-term increase during the next fifty years, the food requirement (on the basis of population and economic-activity assumptions of this study) would rise about 48 percent during the period 1950-75, and about 100 percent during the period 1950-2000.

Energy Material Requirements

Energy material requirements are of minor interest in the present study, because fuelwood is the only energy material that is also a timber product. The prolonged decline in the relative importance of wood as a source of energy has been mentioned in Chapter V. It seems unlikely that this trend will change very much, regardless of the prospective expansion of energy-material demand.

The intake of energy material over the period 1900-52 shows a fairly consistent relationship to gross national product. If that relationship should prevail during the next half century, energy-material requirements (on the basis of the gross national product assumptions of this study) would increase 75 percent during the period 1950-75, and 200 percent during the period 1950-2000. This implies a per capita consumption increase of 26 percent during the 25-year period 1950-75 and of 66 percent during the 50-year period 1950-2000.

The great unknown, of course, is the extent to which the nonconventional sources of energy (atomic, solar, wind, etc.) will be utilized. It seems pretty certain that one or all of these sources will be tapped. Even now commercial utilization of the nonconventional sources is chiefly a question of economics.

Physical-Structure Material Requirements

Physical-structure material requirements are a major interest in the present study because practically all timber products, except fuelwood, are of this type.

The intake of physical-structure material over the period 1900-52 also shows a fairly consistent relationship to real gross national product. The relationship is graphically illustrated in figure 1. Gross national product, in terms of 1947 constant dollars, is plotted on the vertical axis. Quantity of physical-structure material consumed is plotted on the horizontal axis. The straight line drawn through the dot-pattern is the regression line.

If the relationship of physical-structure material consumption to real gross national product, illustrated in figure 1, should continue to hold during the next twenty-five years, the Nation's consumption of this type of material (on the basis of assumptions used in this study) would increase about 70 percent during the period 1950-75. If the relationship should hold for fifty years, the increase during the period 1950-2000 would be of the order of 200 percent.

The chief question regarding such statistically derived figures is whether technological economy in the utilization of this type of raw material will develop at about the same relative pace as in the past. This study assumes that it will develop more rapidly.

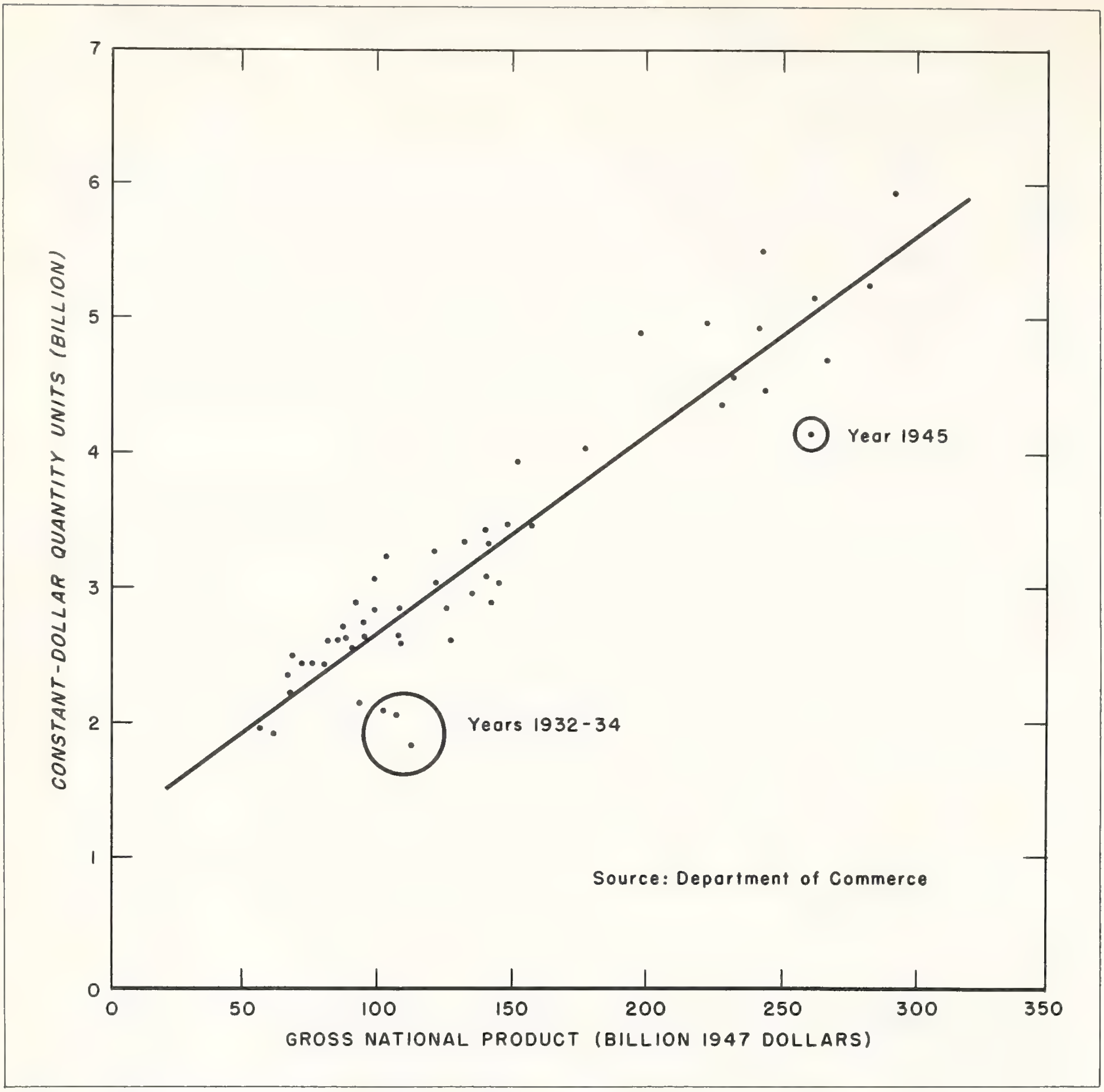

Fig. 1- Relationship of physical-structure materials intake to gross national product, 1909-52.

Anticipating such technological economy, the projected 1975 requirement for physical-structure material is estimated at 60 percent above 1950 consumption; the year 2000 requirement is estimated at 135 percent above that average. This implies a per capita increase of about 13.5 percent during the 24-year period 1950-75 and of about 27.5 percent during the 50-year period 1950-2000. This is approximately the same per capita increase that occurred over the period 1900-50.[11]

Summary

Summarizing raw-materials consumption outlook that appears to be reasonably consistent with population and gross national product assumptions underlying the present study, the following percentage increases of consumption are indicated:

	Percent increase	
	[1]1950-75	[1]1950-2000
Food	48	100
Energy material	75	200
Physical-structure	60	135

[1] Actually, the 1948-52 average centered on 1950.

PROJECTIONS OF RESIDENTIAL AND NONRESIDENTIAL CONSTRUCTION

The plan of analysis followed throughout this chapter involves a continuing effort to keep pertinent features of the Nation's probable future economic growth in mind. Prior to consideration of the potential demand for timber products, a series of projections for future construction activity have been made. These constitute a part of the basic assumptions.

Projected Future Requirements for New Housing

The prospective future requirements for new housing have been analyzed from two points of view.

The first part of the analysis presents estimates of the amount of new housing that would be required by a 1975 population of 210 million and a 2000 population of 275 million to: (1) accommodate the net increase in number of households; (2) maintain a reasonable margin of seasonal and other unoccupied dwelling units; (3) replace normal disaster losses caused by fire, storm, and flood; and (4) replace obsolescent, substandard, and otherwise unusable housing--including that demolished by reason of changes in use of the land on which it stood.

The second part of the analysis is a projection of the demand for new housing in terms of the investment capital that may be available for this use and the personal income that may be available for long-term purchase or rental of housing.

Estimates Based on Population Analysis

The number of households requiring shelter at any specified year prior to 1975 can be estimated fairly well. The reason is that only a few persons not already born will be old enough by 1975 to have set up their own households.

Estimating number of households at various times between 1954 and 1975 calls for consideration of three main factors: (1) mortality of the population age 20 and older during the next twenty years, (2) net civilian immigration, and (3) changes in the ratio of population age 20 and older to number of households.

[11] See Bureau of the Census, RAW MATERIALS IN THE UNITED STATES ECONOMY, 1900-1952, Washington, D. C. 1954. p. 59.

The Census Bureau's 1955-75 projection[12] of the United States population takes account of both mortality and net immigration.

With regard to mortality, the Bureau assumed that average life-expectancy will continue to increase at a rate somewhat less than has prevailed during recent years. That assumption is reasonable because, undoubtedly, there is some final limit to average duration of human life. As that limit is approached, the rate by which average life-expectancy is increased will tend to slacken.

The Bureau assumed that net immigration will average about 1, 200, 000 persons every five years, or 240, 000 annually. That assumption in the light of recent experience, also appears to be reasonable.

Relation of households to population age 20 and older. Analysis of the decennial census data over the period 1890-1950 shows that the number of households has been closely related to population age 20 and older (fig. 2).

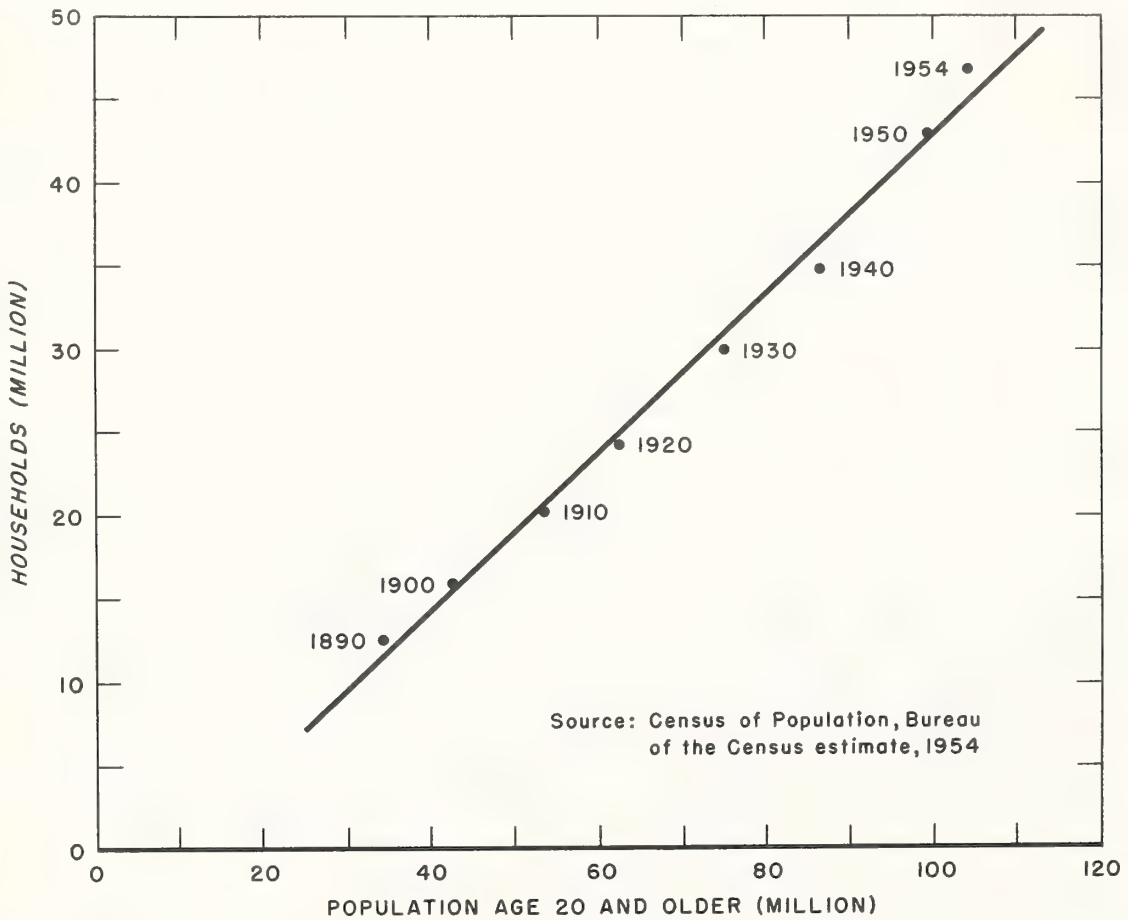

Fig. 2 - Relationship of population age 20 and older to number of households, specified years.

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[12] U. S. Bureau of the Census, ILLUSTRATIVE PROJECTIONS OF THE POPULATION OF THE UNITED STATES, 1955-1975. Current Population Reports, Series P-25, No. 78. Washington, D. C. August 1953.

The Census Bureau's four 1955-75 projections of United States population are different only with respect to projected number of persons who may be born between 1950 and 1975. For those already in the population (as of July 1, 1950), the Bureau has made only one projection (table 5). That projection is consistent with the population assumption used throughout this study.[13]

TABLE 5.--Bureau of the Census projection of United States population age 20 and older, 1955-75

[In thousands]

Age group	1950	Projection to--				
		1955	1960	1965	1970	1975
20-24	11,621	10,775	11,282	13,463	17,299	[1] 18,819
25-29	12,314	11,713	10,875	11,361	13,558	17,421
30-34	11,612	12,367	11,775	10,908	11,396	13,599
35-39	11,298	11,618	12,379	11,761	10,895	11,382
40-44	10,271	11,236	11,569	12,300	11,685	10,825
45-49	9,115	10,118	11,083	11,386	12,105	11,500
50-54	8,298	8,830	9,825	10,741	11,034	11,732
55-59	7,266	7,873	8,402	9,331	10,203	10,482
60-64	6,082	6,685	7,279	7,754	8,614	9,422
65 and over	12,364	13,973	15,701	17,336	18,885	20,689
Total	100,241	105,188	110,170	116,341	125,674	135,871

[1] This figure is midway between the Bureau's Series B and Series C projections of persons born in the period 1950-55. U. S. Bureau of the Census, ILLUSTRATIVE PROJECTIONS OF THE POPULATION OF THE UNITED STATES, By Age: 1955 to 1975, Current Population reports, Ser. P-25, No. 78, Washington, D. C., August 1953.

The further 1975 to year 2000 extension of the Bureau's 1955-75 projection of population age 20 and older is likewise consistent with the population assumption of the present study.[14] However, that 1975-2000 extension implies birthrates somewhere near the level of the Census Bureau's medium assumptions for 1970-75. Those medium assumptions imply that 1970-75 birthrates will be well below recent levels and below past levels except those of the period 1935-39.[15]

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[13] That total population in 1975 will be 210 million.

[14] That total population in 2000 will be 275 million.

[15] The crude birthrates (births per 1,000 of the midperiod population) for specified periods of the past, and those implied in the Census Bureau's two medium 1955-75 population projections are as follows:

Birthrates in past	
Period	Rate
1910-14----	29.8
1920-24----	26.8
1930-34----	19.7
1935-39----	18.8
1940-44----	21.2
1945-49----	24.1
1950-53----	24.8

Census Bureau's medium assumptions		
Period	Series B	Series C
1950-55-----	24.2	24.1
1955-60-----	22.3	21.0
1960-65-----	21.9	19.4
1965-70-----	21.1	19.2
1970-75-----	19.4	19.1

Source: Same as cited in footnote 12.

A population of 275 million at the year 2000 implies a fall in the birthrate back to about the 1930-34 level. Such a fall in the birthrate would imply a percentage of population age 20 and older considerably above that projected for 1975. The increase might be from the projected 1975 level of 64.7 percent back to somewhere above the 1950 level of 66.1 percent. On that basis, population age 20 and older at the year 2000 is estimated at 182 million persons (table 6).

TABLE 6.--Population 20 years of age and older, number of households, and average persons 20 years and older per household, at specified years 1890-1954; projection to 1975 by 5-year intervals and to the year 2000

Year	Population 20 years of age and older[1]	Number of households[2]	Average persons 20 years and older per household
	Thousand	*Thousand*	*Number*
1890	34,148	12,690	2.69
1900	42,314	15,964	2.65
1910	53,410	20,256	2.64
1920	62,668	24,352	2.57
1930	75,116	29,905	2.51
1940	86,364	34,855	2.48
1950	99,598	42,826	2.33
1954	103,991	46,893	2.22
		Projections	
1960	[3] 110,170	[4] 50,100	2.20
1965	116,341	53,900	2.16
1970	125,674	58,900	2.13
1975	135,871	65,000	2.10
2000	182,000	91,000	2.00

[1] Data for 1890 through 1950 from Census of Population; estimate for 1954 by Bureau of the Census, CURRENT POPULATION REPORTS, Ser. P-20, No. 56. March 1955.
[2] Data for 1890 through 1950 from 1950 CENSUS OF HOUSING, Report H-Al, p. xxviii. Estimate for 1954 by Bureau of the Census, CURRENT POPULATION REPORTS. Ser. P-20, No. 56. March 1955.
[3] Projection for 1960 through 1975 by Bureau of the Census, CURRENT POPULATION REPORTS, Ser. P-25, No. 78. August 1953.
[4] Based on the specified ratios of population 20 years of age and older to households.

The ratio of population age 20 and older to number of households has decreased from 2.69 to 1 in 1890, to 2.22 to 1 in 1954 (table 6). The rate of decrease since 1940 has been more rapid than previously. Part of this can be accounted for in the decline in number of families living "doubled up" in one dwelling unit. It is also probable that Social Security, private pension systems, and other factors have enabled more older people to maintain independent households. There may have been some increase in the number of unmarried persons living in separate dwelling units rather than in boarding houses. Such trends are likely to continue.

The projected future decrease in the ratio of population age 20 and older to households is predicated on the relative certainty that the percentage of such population age 65 and older will increase from the 1950 level of 12.3 percent to at least 15 percent by 1975.[16]

The 1950 Census of Housing indicated that households headed by persons age 65 and older average about 2.0 persons per household. The average number of persons for all households was 3.4. The prospective percentage increase of persons age 65 and older

[16] Based on figures shown in the last two lines of table 5.

would, therefore, tend to decrease the ratio of population (age 20 and older) to households, perhaps as indicated in table 6--from 2.22 to 1 in 1954, to 2.10 to 1 in 1975, and to 2.00 to 1 by the year 2000.

The conclusion reached by the methods indicated above is that the number of occupied dwelling units at specified future dates might be as indicated by the projections in table 6. Up to 1975 these estimates are likely to be fairly accurate. Uncertainty regarding future birthrate is a very minor factor.

The validity of the year-2000 estimate depends, however, upon whether birthrates in the future actually do return to levels similar to those of the 1930's. If they remain above the 1930's rates, the projection will turn out to have been too low.

Average annual net increase of households. The average annual net increase of households (or occupied dwelling units) during specified periods 1890 to 1954, with projections through 1960-75 and to the year 2000 is as follows:

Period	Thousand households	Period	Thousand households
1890-1900	327	1950-54	1,017
1900-10	429	1954-60	535
1910-20	410	1960-65	760
1920-30	555	1965-70	1,000
1930-40	495	1970-75	1,220
1940-50	797	1975-2000	1,040

The prospective slump in new household formation that looms ahead in the period 1955-65 will be due, chiefly, to the low birthrates that prevailed during the 1930's. The upsurge that will occur after 1965 will be due to the higher birthrates prevailing since 1940.

Margin of unoccupied housing. Unoccupied dwellings normally found in the Nation's housing inventory include several categories. The 1950 Census of Housing reported the following breakdown:

Unoccupied dwelling units	Thousand units	As percent of occupied units
Resident was temporarily away	127	0.3
Seasonal dwelling units (nonfarm and farm)	1,050	2.5
Nonseasonal, not dilapidated, not for sale or rent	743	1.7
Total unoccupied units not on the housing market	1,920	4.5
Nonseasonal, not dilapidated, for sale or rent	732	1.7
Nonseasonal, dilapidated	505	1.2
All unoccupied dwelling units	3,157	7.4

Most of the seasonal dwelling units are summer and winter homes occupied for several months of the year. The rest are used to house seasonal agricultural workers, logging crews, and the like.

The "nonseasonal units, not dilapidated, but not for sale or rent" included some that had recently been sold or rented but not yet occupied.

Those classified as "nonseasonal, not dilapidated, for sale or rent" include what may be called the "active vacancy." It was probably much lower than usual in 1950.

"Nonseasonal, dilapidated" units include a good many "on their way out" of the Nation's housing inventory but not yet demolished or converted to nonresidential uses. In 1950, some 44 percent of such units were on farms, 36 percent were classified as rural nonfarm, 22 percent as urban. It is evident that many of such units were unoccupied as the result of migration from agricultural to industrial areas.

Looking ahead to the period 1954-75 and to the year 2000, it seems reasonable (under conditions assumed in the present study) to expect that a somewhat larger percentage of families will maintain seasonal summer or winter homes, and that "active vacancy" will increase considerably above the 1.7 percent that existed in the "tight" housing situation of 1950. On the basis of such expectations, it seems likely that all unoccupied dwelling units in the future will be equal to at least 8.0 percent of the occupied units.

Nation's future housing inventory. The Nation's future housing inventory, at specified years, may be about as follows:

	Thousand dwelling units		
Year	Occupied	Unoccupied	Total
1954----------	46,893	3,751	50,644
1960----------	50,100	4,008	54,108
1965----------	53,900	4,312	58,212
1970----------	58,900	4,712	63,612
1975----------	65,000	5,200	70,200
2000----------	91,000	7,280	98,280

The periodic and the average annual net increases of the Nation's housing inventory from 1940 to 1954, and projections through 1954-75 and 1975-2000 are as follows:

	Thousand dwelling units	
Year	Periodic increase	Annual average
1940-50------------	8,658	866
1950-54------------	4,427	1,107
1954-60------------	3,464	577
1960-65------------	4,104	821
1965-70------------	5,400	1,080
1970-75------------	6,588	1,318
1975-2000----------	28,080	1,123

Replacement of disaster losses. Losses to the Nation's housing supply by fire, wind storm, and flood occur all the time. It has been estimated that such losses average about 40,000 dwelling units per year or approximately one-tenth of 1 percent of the current housing inventory.[17]

Much has been done over the years to reduce fire hazard in dwellings and to improve fire protection systems. Further progress along these lines is to be expected. But, on the other hand, the shift of population from more densely settled urban areas to

[17] U. S. Housing and Home Finance Agency, HOW BIG IS THE HOUSING JOB? Government Printing Office, Washington, D. C. 1951.

the rural-urban fringe and to the open country puts a higher percentage of dwellings beyond the reach of the more efficient fire protection systems, and often outside the areas covered by fire-safety building codes. The two factors may approximately offset each other. Flood protection is being improved, but not much has yet been done to prevent further building on flood plains nor to remove present structures from such locations.

On the whole, it seems unlikely that the current annual rate of loss will change very much before 2000. Loss replacement has been projected as follows:

Period	Thousand dwelling units: Periodic replacement	Annual average
1954-60	305	51
1960-65	271	54
1965-70	291	58
1970-75	318	63
1975-2000	2,106	84

Replacement of obsolete and substandard housing. It was pointed out above that some 505,000 dilapidated unoccupied dwelling units counted in the 1950 Census of Housing were probably on their way out of the Nation's housing supply. The total number of dwelling units that actually dropped out of the supply during the 1940-50 decade was probably between 2.0 and 2.5 million units.

At first thought, a 10-year drop-out of 2.5 million units might seem to be excessive, but it is actually much less than would be required to maintain the housing inventory in reasonably good condition. A 10-year drop-out of 2.5 million units from the 1940 inventory means an annual average drop-out of 250,000 units, which is slightly less than seven-tenths of 1 percent. Replacement at the rate of seven-tenths of 1 percent annually implies an average service life of about 143 years. While there are dwellings that can be kept in good condition that long, the average practicable service life for housing is probably nearer half that time. For the long-term future, the rate of replacement of obsolete, substandard, and otherwise unusable housing may be about 1.4 percent annually. That rate would imply an average service life of approximately 70 years.

Discussion of the problem of removal of substandard housing often seems a bit visionary because little progress has so far been made in getting the job done in those areas where slum conditions are most evident. The Subcommittee on Urban Redevelopment of the President's Advisory Committee on Government Housing Policies and Programs estimated the number of dwelling units probably requiring demolition at 5 million.[18] But this subcommittee went on to say:

> There is overwhelming evidence of a great and growing spirit in the cities to face realistically the requirements for slum cure.[19]

What will actually be accomplished on this front by 1975 and by 2000 cannot be estimated with any semblance of precision. The outcome lies in the domain of political decisions.

There is, however, a far more encouraging aspect of the general problem of getting rid of obsolete and substandard housing. The Census Bureau for some years has been making annual sample surveys of internal migration. It has found that about one household out of every five (20 percent) changes its place of residence in the course of one year (table 7).

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[18] REPORT TO THE PRESIDENT OF THE UNITED STATES, Government Printing Office, Washington, D. C. December 1953. p. 111.
[19] Same reference as footnote 18.

TABLE 7.--Average annual mobility of the civilian population in the United States, 1947-53

Type of move	Percent
One state to another	3.1
One county to another, in same state	3.3
One house to another, within same county	13.6
Abroad at beginning of the year	0.3
Percentage moving	20.3

Source: U. S. Bureau of the Census. MOBILITY OF THE POPULATION OF THE UNITED STATES, Current Population Reports, Population Characteristics, Series P-20, No. 49, December 1953.

Except for the very small percentage of households occupying trailers, none of these movers take their housing with them. The majority, of course, move into living quarters vacated by someone else. But there are certain basic shifts of population (the migration from agricultural to industrial areas, from urban central districts to suburbs and rural-urban fringe, from the rest of the country to the Pacific Coast States) that result in a surplus of housing throughout certain areas supplying the migrants. The residual population in such areas shifts locally to occupy the best of that housing vacated by the out-migrants. In these situations, there is a buyers' and renters' market. The poorest dwelling units become vacant and soon deteriorate to an unusable condition. Demolition or conversion to some other use follows.

The number of dwelling units demolished, converted to some other use, or deteriorated so badly as to be no longer suitable for use as living quarters, during the 10-year period 1940-49, appears to have been somewhere between 2.0 and 2.5 million. This estimate is based on a State-by-State comparison of the 1940-49 net increase of dwelling units against the number of units reported built during that same period, as shown by the Census of Housing figures.

In 31 States, the number of units reported built in the years 1940-49 was greater than the net increase. That deficiency represents the difference between the number of units gained by conversion and the number dropped from the housing inventory by disaster losses, demolition, abandonment and conversion to other uses. This net drop-out in 31 States amounted to 1,136,000 units. The gross drop-out was, of course, considerably more.

In 17 other States the net increase of dwelling units exceeded the reported number built during 1940-49 by 619,000. In that area gain by conversion must have exceeded the drop-out by that number. The gross drop-out, even in these States, must have been a considerable number.

Further checking county-by-county in a sample of States shows that the gross drop-out from the housing inventory due to out-migration and the gross gains by positive conversion to meet demands due to in-migration were substantially larger than indicated by the "net" figures on a State-by-State basis. This is the evidence that supports the estimate of a 2.0 to 2.5 million gross drop-out of dwelling units from the Nation's inventory during the period 1940-49.

The 1940's, as a whole, were years of critical housing shortages. It seems likely that the conversion potentialities in most of the older housing were pretty well exploited during that period. The bulk of the dwelling units built in the past 20 years are too small to be subdivided in the way that older houses have been. It is, therefore, doubtful that conversion will yield anywhere near the number of additional dwelling units in the next 20 to 45 years that it has in the past.

On the basis of the reasoning presented above, the replacement of obsolete, substandard, and otherwise unusable dwelling units[20] has been projected at the annual rate of 1.4 percent of current inventory. Those projections by periods and annual average are as follows:

Period	Thousand dwelling units: Periodic replacement	Annual average
1954-60	4,272	712
1960-65	3,790	758
1965-70	4,075	815
1970-75	4,455	891
1975-2000	29,475	1,179

Prospective average annual requirement for new housing. The prospective average annual requirement for new housing (nonfarm and farm combined) arrived at by the foregoing method of estimating is summarized in table 8.

TABLE 8.--Projected average annual requirement for new farm and nonfarm housing, 1954-75 and 1975-2000

Item	1954-60	1960-65	1965-70	1970-75	1975-2000
	Thousand	*Thousand*	*Thousand*	*Thousand*	*Thousand*
Net addition to inventory[1]	577	821	1,080	1,318	1,123
Disaster-loss replacement	51	54	58	64	84
Obsolescence replacement[2]	712	758	815	891	1,179
Total	1,340	1,633	1,953	2,273	2,386

[1] For net increase of households with maintenance of an 8.0 percent margin of seasonal and other unoccupied units.
[2] Including replacement of substandard housing and units demolished as the result of land-use changes.

For the 6-year period immediately ahead (1954-60) the average annual requirement appears to be somewhat below recent levels of residential construction.

Whether there actually will be a sag in residential construction in that period depends upon the rate at which obsolescent and substandard housing is replaced. With the estimated backlog of 5 million substandard dwelling units now on hand, the replacement job would admirably fill the gap between the present and the next surge of household formation which will begin about 1965.

Housing Requirements Based on Estimated Demand, 1975 and 2000

Estimates of future housing requirements based entirely on the population-analysis approach, used above, often encounter the objection that such estimates are measurements of "need." This objection may be followed by the question: "Will the population of this country be able and willing to afford that much new housing at the specified future dates?"

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[20] Including replacement of units demolished as the result of changes in land use from residential to industrial and commercial, and for widening and relocation of streets, and highways, or the like.

For an answer to such a question, it is necessary to rely upon past experience modified by consideration of any new factors that are likely to come into operation.

Estimates of the annual expenditures for new nonfarm residential construction and of the number of new permanent dwelling units started are available for the period 1929-54.[21] Because these estimates do not include farm residential construction, that part of the housing demand picture will have to be considered separately.

Projected demand for new nonfarm housing. Another handicap in using the existing information on expenditures for new nonfarm residential construction and volume of such housing constructed is the fact that the period 1929-54 includes the years of the Great Depression and the years of World War II. In both of these periods, residential construction was much below normal levels. The combined influence of depression and of war produced one of the most critical housing shortages the country has ever had.

The average relationship of expenditures for new nonfarm residential construction to gross national product over the entire 25-year period is, undoubtedly, a better indication of what to expect in the future than the relationship during any part of the period. But even for the period as a whole, residential construction played a less important role than would be expected under the assumed future conditions of high-level employment and avoidance of all-out war.

Annual gross national product in 1953 constant dollars, annual expenditures (also in 1953 constant dollars) for new nonfarm residential construction, and estimated number of new permanent nonfarm dwelling units started annually, in the years 1929 through 1954, are shown in table 9.

Annual expenditures as percent of gross national product were as follows:

Year	Percent	Year	Percent
1929	4.9	1942	1.6
1930	3.2	1943	.6
1931	2.9	1944	.4
1932	1.8	1945	.6
1933	1.3	1946	2.2
1934	1.4	1947	2.8
1935	2.2	1948	3.4
1936	2.8	1949	3.4
1937	2.8	1950	4.6
1938	3.0	1951	3.6
1939	4.0	1952	3.4
1940	4.1	1953	3.4
1941	3.8	1954	3.8

For this period as a whole, these expenditures amounted to 2.8 percent of gross national product.

[21] There is a strong probability that these estimates, both for expenditures and for number of dwelling units started, are considerably short of what was actually done. The estimated number of dwelling units started during the period 1940-49 is about 40 percent less than the Census of Housing 1950 count of dwelling units in structures built during the years 1940-49. Some of this difference can be explained by the fact that temporary public housing built in defense areas was not included in the "starts" estimates. There are a number of other differences in definition and coverage. But when all these factors are considered, it still seems very probable that the number of dwelling units actually built in the 1940's exceeded the estimated "starts" by a substantial margin.

The current estimates of dwelling units started are based on a more complete coverage of the local Government units that issue building permits and on improved sampling of areas in which building permits are not required. These later estimates would be expected to have a smaller margin of error.

TABLE 9.--Gross national product, expenditure for new permanent nonfarm residential construction, and number of dwelling units started, 1929-54; projection to 1975 and to 2000

Year	Gross national product in 1953 dollars[1]	Expenditure in 1953 dollars[2]	Dwelling units started[3]	Year	Gross national product in 1953 dollars[1]	Expenditure in 1953 dollars[2]	Dwelling units started[3]
	Billion	*Billion*	*Thousand*		*Billion*	*Billion*	*Thousand*
1929	175.9	8.7	509	1945	319.9	1.8	209
				1946	283.4	6.2	671
1930	159.2	5.1	330	1947	282.8	8.0	849
1931	147.7	4.3	254	1948	293.3	10.0	932
1932	125.3	2.2	134	1949	294.2	10.0	1,025
1933	123.4	1.6	93				
1934	136.3	1.9	126	1950	320.1	14.6	1,396
				1951	343.6	12.2	1,091
1935	150.3	3.3	221	1952	354.1	11.9	1,127
1936	170.2	4.8	319	1953	364.9	12.3	1,104
1937	179.6	5.0	336	1954	357.1	13.6	1,220
1938	171.8	5.2	406				
1939	187.9	7.6	515			Projections	
1940	205.7	8.4	603	1975	630.0	[4] 22.0	[5] 2,000
1941	239.2	9.0	706				
1942	271.7	4.4	356	2000	1,200.0	[4] 42.0	[5] 3,800
1943	305.9	1.9	191				
1944	329.3	1.4	142				

[1] U. S. Council of Economic Advisors, ECONOMIC REPORT OF THE PRESIDENT. U. S. Government Printing Office. 1954-55.

[2] Estimates of private expenditure published by U. S. Department of Commerce in NATIONAL INCOME 1954 EDITION converted to 1953 dollars by use of Department of Commerce implicit price deflator for this segment of gross national product. Estimates further adjusted to include expenditures for new permanent publicly-owned nonfarm dwelling units at same cost per unit as for private.

[3] Includes both privately and publicly owned units. U. S. Bureau of Labor Statistics' estimates. Published in ECONOMIC REPORT OF THE PRESIDENT, 1955. 1954 estimate as revised by Bureau of Labor Statistics.

[4] Assuming that such expenditure would amount to 3.5 percent of projected gross national product.

[5] Based on 1950-54 ratio of expenditure to number of units started.

Because new household formation during the depression years was below normal, and because the economic demand for new housing during the World War II years had to be denied by government action, it is not reasonable to expect that future demand for new nonfarm housing in relation to gross national product (under conditions assumed in this study) would be as low as the 1929-54 average. Neither is it likely to be as high as some of the peaks in that period.

A choice for purposes of making a tentative projection might be 3.5 percent.[22] On such a basis the 1975 expenditures for new nonfarm residential construction would be $22 billion, and the year 2000 expenditures would be about $42 billion.

At the 1950-54 ratio of construction expenditures (in 1953 constant dollars) to number of new nonfarm dwelling units started, the 1975 starts would be just over 2.0 million; the year-2000 starts would be above 3.8 million. Further consideration of these two figures will come later after some attention has been given to probable future demand for new housing on farms.

Projected demand for new housing on farms. The most reliable information on number of new dwellings built on farms during various periods of the recent past is the "year built" data collected by the 1940 and 1950 Censuses of Housing. One of the questions asked about each farm dwelling unit by the census enumerators was "in what year was this structure built."

The count thus made in 1940 of dwellings built in the periods 1920-24, 1925-29, 1930-34, and 1935-39 included only those dwelling units that were still standing on properties classified as farms in 1940. It did not include farm dwellings built prior to 1940 which: (1) had been lost by fire, wind, and flood; (2) had been demolished or converted to other uses; and (3) had been shifted from farm to nonfarm status by reason of a change in use of the land on which they were located. These three factors are of considerable importance. This same observation applies to the 1950 census count of farm dwellings built in the periods 1940-44 and 1945-49.

It is, therefore, evident that the number of farm dwellings actually built during each of the 5-year periods must have been considerably more than the numbers that were still standing on farms in 1940 and 1950. The margin of difference between the number actually built and the number standing at the time of count is probably greater with each successive period prior to 1940 and 1950.

Bearing these qualifications in mind, it appears that the number of dwelling units built on farms during each 5-year period from 1920 through 1949 was somewhat in excess of the following:[23]

Period	Thousand dwelling units built: During the period	Thousand dwelling units built: Annual average
1920-24	695	139
1925-29	567	113
1930-34	571	114
1935-39	719	144
1940-44	317	63
1945-49	626	125

[22] Stanford Research Institute has projected expenditure for new nonfarm residential construction in 1975 at 3.3 percent of gross national product. The S. R. I. projection of gross national product for 1975, however, is about 7 percent lower than the gross national product projection used in this study. See discussion of gross national product projections above.

The S. R. I. projection of 1975 expenditures for new nonfarm residential construction amounts to $19.5 billion at 1952 prices. AMERICA'S DEMAND FOR WOOD, 1929-1975, pp. 12 and 16.

The staff of the Joint Congressional Committee on the Economic Report has projected expenditures for private new nonfarm residential construction in 1965 at 2.99 percent of gross national product. With the inclusion of public residential construction that figure would be raised somewhat. See POTENTIAL ECONOMIC GROWTH OF THE UNITED STATES ECONOMY DURING THE NEXT DECADE, p. 20.

[23] U. S. Bureau of the Census, CENSUS OF HOUSING 1940, CENSUS OF HOUSING 1950.

Judging from what is known about the later wartime restrictions on residential construction and the farm labor shortage, it is certain that the number of new dwellings built in 1945 and 1946 was well below the average for the 1945-49 period as a whole. It is equally apparent that the numbers built in 1947, 1948, and 1949 must have been well above the 1945-49 average of 125,000. The number actually built in the last three years of the period must have been about 150,000 per year. It is probable[24] that farm residential construction has been somewhere near the 150,000 per year level since 1950.

Looking forward to 1975 and to 2000, it seems probable, under the assumptions of this study, that population on farms may continue to decrease for some time. But in view of the prospective increases in requirements for food and fiber by the Nation's growing total population, the absolute decrease in farm population cannot be expected to continue indefinitely.

If the relationship of (constant-dollar) farm gross national product[25] to total (constant-dollar) gross national product that has prevailed during the period 1910-53 holds during the next period of comparable length, the 1950-75 increase of farm gross national product will be about 30 percent, and the 1950-2000 increase will be about 90 percent. If the 1975 farm population (probably somewhat smaller than at present) gets its due monetary return from this increased physical output, it will have the purchasing power to raise farm housing standards to levels much higher than now exist.

Considering prospective increase of real farm income, recent levels of farm residential construction activity, recent extension of Federal credit aids to the farm-housing field, and the present run-down condition of much of the farm-housing inventory, it seems reasonable to project economic demand for new farm housing in the 1955-75 period at 150,000 dwelling units annually. For the period beyond 1975, the job of replacing substandard farm housing might be smaller, but on the other hand, there may be some increase in the number of farms. A continuation of the 150,000 per year annual demand would not be unreasonable.

Projected total demand for new housing, 1975 and 2000. Adding the estimated 1975 demand for new farm housing, arrived at above, to the estimate of demand for new nonfarm housing indicates a total demand slightly lower than the previous estimate based on population analysis--2,150 thousand units against 2,270. But, estimates more nearly alike could hardly be expected.

With respect to year 2000, however, the two methods give results that are radically different. The estimate based on economic projection indicates a potential demand for 3,950 thousand units. The population-analysis approach indicates a requirement of only 2,390 thousand. That wide difference in results is due chiefly to the previously-mentioned assumption that the 1975-2000 birthrate will be somewhere near the low level of the early 1930's. While that may be a somewhat questionable assumption, it was the one chosen by the Bureau of the Census for its "medium" population projections through the latter part of the 1955-75 period. Extension of those medium Census Bureau projections, for purposes of the present study, imply acceptance of the low birthrate assumption.

Because the lower figure of 2,390 thousand dwelling units for the year 2000 requirement is more consistent with the basic population assumption used throughout the present study, the high projection of economic demand (3,950 thousand units) has been discarded.

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[24] According to the U. S. Department of Agriculture estimates of expenditures for construction of new farm operators' dwellings. Published in U. S. Department of Commerce, CONSTRUCTION AND BUILDING MATERIALS.

[25] That portion of gross national product originating on farms. It is a value-added concept obtained by subtracting from the total value of farm output the value of (intermediate) materials used up in the farm production process, such as fertilizer, purchased feed, and motor fuel.

See Atkinson, L. Jay and Jones, Carl, "Farm Income and Gross National Product, Part II, Farm Gross National Product 1910-53." SURVEY OF CURRENT BUSINESS, August 1954.

It is pertinent to observe, however, that the indicated economic demand at year 2000 (assuming a population of 275 million) would be more than ample to absorb 2,390 thousand units.

Aside from the fact that economic analysis cannot foretell the future, statistical estimates of potential demand for new housing, based on a projection of expenditures for new residential construction, and upon the 1950-54 ratio of such expenditures to number of new dwelling units started, are not entirely convincing. Other factors to be considered include the volume of savings that may in the future be funneled into this type of investment, and the amount of real disposable personal income that people may have to spend for the purchase or the rental of such new housing.

With respect to procurement of investment capital for residental construction, inferences based on past experience must be supplemented by recognition of policy and institutional changes during the last two decades. A recent study made for the National Bureau of Economic Research points out:[26]

> Federal credit aids occupy a strategic position in residential construction. Introduced only 17 years ago, they are today deeply imbedded in the process of capital formation and financing in residential real estate......the aids themselves have become widely accepted as essential parts of the institutional framework in which new housing is produced and financed..........
>
> If the Government's present influential role in housebuilding finance is increased, investment in residential construction may in the future be less sensitive to the competition of other potential investment uses for savings.

The statement just quoted was published in 1953. Within a year, the Housing Act of 1954 had, in fact, increased the government's role in housebuilding finance by liberalizing Federal home-mortgage insurance in a number of ways: It raised the ceiling on insurable home mortgages of 1-and 2-family houses from $16,000 to $18,000; it made certain changes in the value-to-mortgage ratio which have the effect of lowering the down-payment on higher-value houses; it extended the amortization limits of insurable mortgages from periods varying from 20 to 30 years to a uniform 30 years. The Act contains a number of other provisions that will tend to encourage and maintain a high level of residential construction.

This latest action of Congress, taken after extensive re-examination (by a new administration) of Federal policy and programs in the housing field, tends to confirm a conclusion reached by the author of the study mentioned above:[27]

> On the whole, past and projected Federal policies in this field may be interpreted as efforts to raise permanently the proportion of total resources devoted to housing construction above the level that would be obtained from the interplay of market forces.

If this inference is as sound as it appears to be, the prospects for a continuing large flow of capital into residential construction are favorable.

But procurement of capital to finance construction of new housing will be sustained only on condition that the persons who occupy such new housing are financially able and willing to make the required payments on their home mortgages and to pay the required rents on rental housing. The long-term prospects on this front are favorable also.

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[26] Grebler, Leo, THE ROLE OF FEDERAL CREDIT AIDS IN RESIDENTIAL CONSTRUCTION, National Bureau of Economic Research, New York. 1953. pp. 13-14.

[27] From page 62 of reference cited in footnote 26.

Per capita real disposable personal income[28] increased by 44 percent during the 24-year period 1929-53. If gross national product increases to the 1975 and 2000 projected levels, the increase of real per capita disposable personal income over the 1953-75 period would amount to about 30 percent. For the period 1953-2000, the increase would be about 90 percent. There is reason to expect that a part of this increase of personal income would be spent for better housing.

There is also reason to expect that the proportion of families in the lowest income brackets--those outside the company of potential buyers of new housing--will be less than at the present time. The trend has been in that direction and there is little chance that it would be halted or reversed under the conditions assumed in this study.[29]

The chief uncertainty about the future level of residential construction does not pertain to the 1965-75 period when family formation will almost certainly be at a high level. The more difficult problems and the greatest uncertainty will be encountered in the decade immediately ahead--1955-65 when family formation will be at a much lower level.

Maintenance of a high level of residential construction during the next 10 years will depend very largely upon the extent to which the present 5 or 6 million backlog of substandard dwelling units are replaced. The so-called "trickle-down" process whereby households keep moving from poorest to better housing will continue as real disposable personal income increases, but it is not likely that this process will rapidly eliminate substandard housing. It will probably have to be bolstered by the more direct approach of effectively-organized "urban renewal" or "urban development" programs such as authorized in the Housing Act of 1949 and 1954.

Final Estimates of Requirements for New Housing, 1960-75 and 2000

The various considerations set forth above have prompted adoption of the following schedule as the probable average annual requirement for new dwelling units--both nonfarm and farm:

Period	Thousand units
1955-59	1,300
1960-64	1,600
1965-69	1,900
1970-74	2,200
1975-2000	2,400

Relationship of Demand for New Housing to Demand for Lumber

This preceding extensive analysis of future prospects for residential construction seems justifiable for the reason that one-third or more of the total volume of lumber consumed goes into residential construction. The lumber used in housing amounts to about 20 percent of all timber products consumed other than fuelwood. The lumber industry, and timber producers in general, have an obvious large stake in the stabilization of residential construction.

Future Requirements for New Nonresidential Construction

Another important use of lumber and some other timber products is in nonresidential construction. Such construction includes industrial and commercial buildings, schools, and churches, and all other nonresidential buildings; public utilities, highways, airports,

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[28] Personal income minus taxes, adjusted for changes in the buying power of the dollar. See U. S. Department of Commerce, NATIONAL INCOME, 1954 edition, page 24.

[29] For a convenient summary of evidence on this matter and references to literature, see Hoyt, Elizabeth E. and others, AMERICAN INCOME AND ITS USE, Harper Brothers, New York. 1954. Pp. 125-136.

military facilities, projects for the conservation and development of waterpower, and other natural resources; and some other miscellaneous categories.

It so happens that information on the use of timber products (especially crossties) by the railroads is more reliable than any available for other kinds of nonresidential construction. Since the railroads, by themselves, account for a considerable part of the timber products used in nonresidential construction, consideration of railroad requirements is excluded here and taken up later in this chapter. Nonresidential construction on farms is likewise deferred until later.

The lack of any other practicable device for measuring the physical volume of such heterogeneous projects as factory buildings, theaters, school buildings, miles of power line, flood control dams, or the like, compels the use of the constant-value-dollar concept as an index of the annual output of various kinds of nonresidential construction. It is the same concept as the constant-dollar quantity unit of raw materials explained in Chapter V. When applied to construction, however, constant-dollar volume includes labor and other contributions that went into the placement of the construction. The point to be stressed is that a constant-dollar index is intended to reflect physical quantity rather than monetary expenditures.

Estimates of the constant-dollar volume of nonresidential construction (in terms of 1947-49 prices) are published monthly by the Department of Commerce.[30] Yearly figures are available for the period 1915-54.[31] That Department of Commerce index converted to a 1953 price basis for private and public nonresidential construction (excluding farm and railroad) is shown in table 10.

TABLE 10.--Estimated value of new nonresidential construction other than farm and railroad, put in place annually, 1915-54

[In terms of 1953 prices]

Year	Private	Public	Total	Year	Private	Public	Total
	Billion dollars	*Billion dollars*	*Billion dollars*		*Billion dollars*	*Billion dollars*	*Billion dollars*
1915	3.9	2.9	6.8	1930	8.2	6.5	14.6
1916	4.7	2.4	7.1	1931	5.3	6.7	11.9
1917	4.2	3.7	7.9	1932	2.8	5.5	8.4
1918	3.2	5.6	8.7	1933	2.1	4.1	6.2
1919	3.9	4.2	8.0	1934	2.1	4.9	7.0
1920	5.4	2.1	7.5	1935	2.3	5.1	7.3
1921	4.9	3.0	8.0	1936	3.2	7.6	10.8
1922	5.9	3.6	9.5	1937	4.2	6.3	10.5
1923	6.5	3.1	9.6	1938	3.3	7.2	10.5
1924	6.9	3.7	10.6	1939	3.5	8.3	11.8
1925	7.8	4.3	12.1	1940	4.2	7.5	11.7
1926	9.0	4.4	13.4	1941	5.2	11.3	16.5
1927	9.4	5.0	14.3	1942	2.6	19.4	22.0
1928	9.3	5.3	14.6	1943	1.2	10.1	11.3
1929	9.8	5.3	15.1	1944	1.7	5.4	7.1

[30] Currently published monthly in CONSTRUCTION REVIEW, U. S. Department of Commerce in cooperation with U. S. Department of Labor, Government Printing Office, Washington, D. C.

[31] The 1915-50 series was published in U. S. Department of Commerce STATISTICAL SUPPLEMENT--CONSTRUCTION AND BUILDING MATERIALS, May 1953. Government Printing Office, Washington, D. C. Revised figures for 1951-54 are in the publications cited in the footnote above.

TABLE 10.--Continued

Year	Private	Public	Total	Year	Private	Public	Total
	Billion dollars	*Billion dollars*	*Billion dollars*		*Billion dollars*	*Billion dollars*	*Billion dollars*
1945	3.2	4.2	7.4	1950	8.1	7.7	15.8
1946	7.6	3.0	10.6	1951	9.2	9.4	18.6
1947	7.1	4.1	11.2	1952	8.9	10.4	19.4
1948	7.8	5.4	13.1	1953	9.7	10.8	20.6
1949	7.6	7.0	14.6	1954	10.1	11.2	21.3

Note: Certain items do not add to totals because each item and total is based on a millions figure.

Source: 1915-50 data from U. S. Department of Commerce, STATISTICAL SUPPLEMENT--CONSTRUCTION AND CONSTRUCTION MATERIALS. May 1953.

1951-54 data from Department of Commerce and Department of Labor, CONSTRUCTION REVIEW. January-March 1955.

The most striking feature of the data in table 10 is the drastic fluctuations that have characterized nonresidential construction activity over the past forty years. After a fairly steady increase from 1915 through 1929, it went into a deep slump that did not reach bottom until 1933. The highest level attained in the later 1930's was still below the levels of 1925-29. The World War II defense effort of 1941 and 1942 shot construction up at an all-time peak, but this was followed by another steep decline as the war effort swung from construction to materiel production. From then on until the end of the fighting, nonresidential construction was deliberately deferred to conserve materials and manpower. After 1946, it took some time to replenish the supplies of building materials and to get going again. Since 1949, the trend of activity has been upward on a fairly steep grade to levels that are near the 1942 peak.

A considerable part of the ups and downs in nonresidential construction has been a reflection of the general fluctuations in the Nation's total economic activity, but that is by no means the whole story. The constant-dollar volume of nonresidential construction put in place expressed as percent of total output of goods and services (constant-dollar gross national product) from 1915 through 1954 has been as follows:

Year	Percent	Year	Percent
1915	6.3	1935	4.9
1916	6.0	1936	6.3
1917	6.5	1937	5.8
1918	6.7	1938	6.1
1919	6.2	1939	6.3
1920	6.2	1940	5.7
1921	7.2	1941	6.9
1922	7.5	1942	8.1
1923	6.8	1943	3.7
1924	7.5	1944	2.2
1925	7.9	1945	2.3
1926	8.3	1946	3.7
1927	8.8	1947	4.0
1928	8.9	1948	4.5
1929	8.6	1949	5.0
1930	9.2	1950	4.9
1931	8.1	1951	5.4
1932	6.7	1952	5.5
1933	5.0	1953	5.6
1934	5.1	1954	6.0

For the 40-year period as a whole, the output of nonresidential construction represented about 5.8 percent of gross national product. The long-term average was approximately the relationship that existed in 1937, 1940, and 1953-54. In all other years it was either above or below the average.

For any activity that has been as unstable as nonresidential construction, no projection into the future can be very reliable. Insofar as can be judged from the figures covering the past 40 years, there seems to be some tendency for this component of gross national product to shrink (percentagewise). On the other hand, it would not be advisable to put too much reliance on such evidence because the last half of the period under observation includes the years of the Great Depression and of World War II. One basic assumption of the present study is that such catastrophes will somehow be avoided during the next fifty years. Furthermore, it is now generally agreed that a fairly high rate of investment in productive facilities is a prime requisite of a strong and reasonably prosperous national economy.

Weighing these considerations, it is reasonable to expect that the nonresidential-construction component of gross national product, averaged over the next fifty years, might not be much less, percentagewise, than it has been over the past forty years. On that assumption, the 1975 estimate of nonresidential construction is $35 billion or 5.6 percent of projected gross national product, and the year 2000 estimate is $60 billion or 5.0 percent.[32]

These figures imply an increase in physical volume of such construction of 64 percent during the period 1954-75, and a further increase (on the 1975 base) of about 70 percent in the 1975-2000 period. It should, of course, be pointed out that unless this type of economic activity attains much greater stability than it has had in the past, an estimate for any particular target year or other short period--even without depression or war--might be low or high by 25 percent or more.

In order, at a later stage, to use these estimates as a basis for indications of potential demand for timber products in nonresidential construction, it is necessary to make some rough allocations to principal categories. This has been done as shown in table 11. Distribution as of 1953 has been used as a guide for the allocation.

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[32] The Stanford Research Institute (AMERICA'S DEMAND FOR WOOD, 1929-1975, p. 16) projection for total new nonresidential construction, including railroad and all construction on farms, in terms of 1952 dollars is as follows:

Year	Billion dollars
1960	18.9
1965	20.5
1970	23.3
1975	25.3

The comparable Department of Commerce (CONSTRUCTION REVIEW, March 1955, p. 12) current-dollar estimates for such construction put in place recently are as follows:

Year	Billion dollars
1953	22.770
1954	23.375

The Department of Commerce has published a 1955 "outlook" estimate which amounts to $25.425 billion (CONSTRUCTION REVIEW, July 1955, p. 10).

While there was some shrinkage in the buying power of the dollar after 1952, this factor has not been very important. In relation to gross national product, construction activity in the nonresidential field was not unduly high in 1953-54.

There would appear to be a strong probability that the S. R. I. projections are much too low.

TABLE 11.--New nonresidential construction, other than farm and railroad, put in place in 1953: projections to 1975 and 2000

[At 1953 prices]

Class of construction	Actual 1953[1]		Projection to--	
	Value	Distribution	1975	2000
	Million dollars	*Percent*	*Billion dollars*	*Billion dollars*
All nonresidential[2]	20,597	100.0	35.0	60.0
Private:				
Industrial bldgs.	[3] 4,000	19.4	6.8	11.7
Commercial bldgs.	1,791	8.7	3.0	5.2
Other private bldgs.	1,660	8.1	2.8	4.9
Utilities	3,974	19.3	6.8	11.6
All other private	120	.6	.2	.3
Total	11,545	56.1	19.6	33.7
Public:				
Public bldgs.	2,581	12.5	4.3	7.5
Military facilities	1,307	6.3	2.2	3.8
Highway	3,165	15.4	5.4	9.2
Sewer and water	861	4.2	1.5	2.5
Public service enterprises	201	1.0	.4	.6
Conservation and development	830	4.0	1.4	2.4
All other public	107	.5	.2	.3
Total	9,052	43.9	15.4	26.3

[1] U. S. Department of Commerce and U. S. Department of Labor, CONSTRUCTION REVIEW, p. 12, March 1955.
[2] Excluding farm and railroad.
[3] Includes $1,771 million of public industrial buildings. See CONSTRUCTION AND CONSTRUCTION MATERIALS, May 1954.

One general comment that can be offered here is that the excessive fluctuations of construction activity are inevitably transmitted to those other industries that supply construction materials. The lumber industry is one of these.

Whatever success any policies and programs designed to give greater stability to construction activity may have in the future will be highly important to the lumber industry. No commodity-producing industry can expect to maintain its own economic health so long as one of its principal markets is continuously in a state of accelerated expansion or excessive contraction.

Future Requirements for Maintenance-and-Repair Construction

Normal maintenance and repair of residential and nonresidential buildings, public utility property, highways, and other facilities undoubtedly absorb a substantial quantity of materials including timber products. The volume of maintenance and repair obviously tends to increase in proportion to the increase of the Nation's inventory of buildings and other facilities.

Information regarding the amount of construction involved in normal maintenance and repair is very scanty. Furthermore, the estimates published by various agencies of the Federal Government have never been fully coordinated or reconciled.[33] One major difficulty in collecting information on expenditures for maintenance and repair is the fact that much of the work is done by private and public agencies on "force account."[34] A substantial amount of residential maintenance and repair is done personally by home owners.

The expenditure estimates that are available indicate that total money outlay for this purpose expressed as percent of the outlay for new construction runs between 40 and 50 percent (table 12). Maintenance and repair, however, tends to be more stable than new construction. In those years when new construction is booming, maintenance and repair is proportionally less; conversely, when new construction is in a depressed condition, maintenance and repair is proportionally greater.

For the 1919-53 period as a whole, maintenance and repair expenditures expressed as percent of expenditures for new construction represented 47 percent. This gives some indication of the materials demand that is generated by maintenance-and-repair construction.

Residential Maintenance, Repair, and Alterations

A Census Bureau field survey of January through May 1954 expenditures for "replacements and repairs" made by home owners on their own properties shows that 70 percent of such persons made that kind of expenditure during the 5-month period.[35] The average for those who made such expenditures was $81 per property. The total expenditure spread over all owner-occupied residential properties would have averaged $50 per property. Assuming that the 5-month period was typical of the whole year, the average annual expenditure per property would amount to $120. With adjustment for those properties that contained more than one dwelling unit, the average must have been about $100 and $110 per dwelling unit. This figure is approximately the same as that obtainable by dividing the Department of Commerce estimate of 1953 total expenditure for residential maintenance and repair ($5.5 billion) by the estimated number (49.8 million) of dwelling units in the Nation's 1953 housing inventory.

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[33] The Department of Commerce has published estimates of current-dollar expenditures for maintenance and repair during the period 1919-53 (CONSTRUCTION AND BUILDING MATERIALS, STATISTICAL SUPPLEMENT, May 1954). This is the only series that covers the whole field of maintenance-and-repair construction. Conceptually, these estimates include only those types of work that would be chargeable to depreciation. They exclude expenditures which, conceptually, would be chargeable to capital improvements. In housing, for example, they exclude major alterations and additions that expand the utility of a structure. Such expenditure, according to Department of Commerce estimating practice, would be classed as new construction expenditure.

The Federal Reserve Board has, in recent years, been obtaining estimates of expenditure for "home improvement and repair" in its Survey of Consumer Finances. This estimate includes a substantial amount of "home improvement" expenditure which the Department of Commerce classifies as new construction.

The Bureau of Labor Statistics published estimates of expenditures for residential "alterations and additions." These estimates are based on building permit data. These estimates, of course, include capital improvements and probably very little maintenance and repair.

In view of the restricted coverage and the conceptual problems encountered in use of other estimates, this study has relied chiefly on the Department of Commerce series.

[34] Work done by agencies for their own account by their own regularly-employed labor force.

[35] U. S. Bureau of the Census, HOUSING AND CONSTRUCTION REPORTS, ALTERATIONS AND REPAIRS, Series H-101, No. 1 December 1954.

TABLE 12.--Estimated expenditure for maintenance and repair expressed as percent of expenditure for new construction, 1915-53

Year	Percent	Year	Percent	Year	Percent
1915	52	1930	44	1945	108
1916	47	1931	50	1946	67
1917	42	1932	72	1947	62
1918	44	1933	86	1948	54
1919	41	1934	79	1949	52
1920	44	1935	74	1950	42
1921	48	1936	58	1951	43
1922	39	1937	55	1952	43
1923	34	1938	55	1953	40
1924	32	1939	48	--	--
1925	31	1940	47	--	--
1926	31	1941	37	--	--
1927	33	1942	32	Average,	--
1928	34	1943	60	1915-53	47
1929	39	1944	100	--	--

Source: U. S. Department of Commerce, CONSTRUCTION AND CONSTRUCTION MATERIALS, STATISTICAL SUPPLEMENT, p. 5. May 1954.

On the basis of this evidence, the future expenditure requirement for residential maintenance and repair has been estimated at $110 (1953 prices) per dwelling unit. The projected housing inventory multiplied by that figure for specified years results in the following estimates of future expenditure:

Year	Projected housing inventory Thousand units	Estimate of maintenance and repair expenditure Billion dollars
1953	49,800	5.5
1960	54,108	6.0
1965	58,212	6.4
1970	63,612	7.0
1975	70,200	7.7
2000	98,280	10.8

Additions and alterations to residential structures. Additions and major alterations to residential structures, according to the Department of Commerce estimating practice, are classified as new construction (footnote 33, page 36). It seems more convenient, however, to discuss this type of construction here along with maintenance and repair.

The only available series of estimated expenditures for this purpose is that made by the Bureau of Labor Statistics from building-permit data. The Bureau of Labor Statistics estimate of total expenditures for additions and alterations of residential structures in 1953 is $1.1 billion.[36]

The difficulty in accepting this estimate at face value is that the Census Bureau's field survey of January through May, 1954 expenditures by home owners for "alterations, improvements, and additions" to their properties suggests the probability that such expenditures may be much higher than indicated by the building-permit information. The

[36] Published in U. S. Department of Commerce, CONSTRUCTION AND BUILDING MATERIALS, STATISTICAL SUPPLEMENT, May 1954.

Census Bureau survey, adjusted to an annual basis, and spread over all owner-occupied properties indicates an average of $165 per property and a total of $4.2 billion.[37] This figure does not include renter-occupied properties. The total for all residential properties would be much higher. Unfortunately, the conceptual differences between what the Bureau of Labor Statistics has been measuring and what the Census Bureau measured in its one-time survey are such that no direct comparison of the two estimates can be made. The best that can be done, with present information, is to use the Bureau of Labor Statistics estimates with the realization that actual expenditures for additions and alterations to residential structures probably exceed these estimates by a substantial amount.

Additions and alterations, presumably, will increase in direct proportion to the increase in the Nation's inventory of dwelling units. On that basis the estimates of future expenditures (at 1953 prices) are as follows:

Year	Billion dollars
1953	1.1
1960	1.2
1965	1.3
1970	1.4
1975	1.6
2000	2.2

Maintenance and additions combined. The combined estimates for 1953 and for specified future-year expenditures for residential maintenance and repair and for additions and major alterations to residential structures are as follows:

Year	Billion dollars
1953	6.6
1960	7.2
1965	7.7
1970	8.4
1975	9.3
2000	13.0

These figures imply a 40 percent increase during the period 1953-75, and a further increase, on the 1975 base, of 40 percent in the period 1975-2000.

Nonresidential Maintenance and Repair, Excluding Railroad and Farm

Department of Commerce estimates of expenditures for nonresidential maintenance and repair (excluding railroad and farm) for the period 1915-53 indicate that money outlay for this purpose has averaged about 35 percent of the corresponding expenditures for new construction. Those current-dollar maintenance and repair estimates are shown in table 13.

Since maintenance and repair would be expected to increase in proportion to the increase of the Nation's inventory of facilities produced by construction, a projection of maintenance-and-repair estimates would, ideally, be tied to the expected increase of such inventory. But since there appears to be no practicable way to make a projection of nonresidential facilities inventory, the next best method seems to be to tie maintenance and repair to the 1975 and 2000 estimates of expenditures for new nonresidential construction. On that basis, using the same periodic percentage increase for both, the

[37] U. S. Bureau of the Census, HOUSING AND CONSTRUCTION REPORTS, ALTERATIONS AND REPAIRS, Series H-101, No. 1. December 1954.

TABLE 13.--Estimated expenditure for nonresidential maintenance and repair, excluding railroad and farm, 1915-53

[Current-dollar basis] [1]

Year	Million dollars	Year	Million dollars	Year	Million dollars
1915	555	1930	1,769	1945	2,829
1916	577	1931	1,526	1946	3,655
1917	636	1932	1,336	1947	4,279
1918	731	1933	1,250	1948	4,908
1919	854	1934	1,520	1949	5,164
1920	993	1935	1,539	1950	5,413
1921	1,196	1936	1,973	1951	6,035
1922	1,233	1937	1,907	1952	6,438
1923	1,287	1938	2,066	1953	6,595
1924	1,414	1939	1,992		
1925	1,478	1940	1,987	--	--
1926	1,565	1941	2,086	--	--
1927	1,651	1942	2,157	--	--
1928	1,660	1943	2,258	--	--
1929	1,740	1944	2,378	--	--

[1] Suitable index for conversion to constant dollars not available.

Source: U. S. Department of Commerce, CONSTRUCTION AND CONSTRUCTION MATERIALS, STATISTICAL SUPPLEMENT, May 1954.

estimates of future expenditures for nonresidential maintenance and repair (excluding farm and railroad) are as follows:

Year	Billion dollars at 1953 prices	
	New construction	Maintenance and repair
1953	20.6	6.6
1975	35.0	11.2
2000	60.0	19.2

The 1953-75 increase would amount to 70 percent and the 1975-2000 increase, on the 1975 base, would amount to 71 percent.

CHARACTERISTICS OF THE TWO SETS OF POTENTIAL DEMAND ESTIMATES

The long-term nature of the potential demand estimates developed in this study favors presentation of "lower-level" and "upper-level" estimates rather than a single set for each of the target years. The charting of a range of potential demand (when considering periods of twenty-five up to fifty years) is obviously more realistic than a procedure which would estimate demand at one level only.

CHARACTER OF THE LOWER-LEVEL ESTIMATES

The lower-level estimates of potential demand have been made on a product-by-product basis with considerable attention to the principal end-uses of the major products. Continuation of current observable substitution trends has been assumed. This includes substitution of one timber product for another, as well as substitution of other materials for timber products. The lower-level estimates assume a substantial increase in the real price of lumber relative to the real price of its competing materials. How much the real-price increase of lumber might be cannot be stated very precisely.[38] What can be said, however, is that the lower-level estimates of lumber demand (46 billion board feet by 1975 and 55 billion by 2000) would involve an estimated decrease in the relative consumption[39] of lumber from 7.0 board feet per constant-dollar quantity unit[40] of physical-structure-material in 1952, to 5.6 board feet by 1975 and to 4.5 board feet by 2000.[41] Such a decrease would amount to 20 percent in the period 1975, and to 35 percent during the longer period 1952-2000. Judging from observations of the 1900-52 relationship of relative consumption of lumber to real price of lumber,[42] these lower-level estimates of demand would not be valid except by assuming a rather stiff real-price increase. With relative consumption dropping to such levels, the 1952-75 real-price increase would probably be not less than 25 to 30 percent, and the 1952-2000 real-price increase would probably be not less than 40 to 50 percent.

An increase in the real price of lumber of such magnitude would undoubtedly be reflected in a general rise in sawtimber-stumpage price, and that would affect other timber products as well. But for products such as pulpwood, which may increasingly

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[38] The practical difficulties of measuring, in precise terms, the influence of price-increase upon demand for lumber were illustrated in Chapter V, pages 6-16.

[39] Consumption of lumber in relation to the consumption of all physical-structure material, with quantity of each weighted by value. See Chapter V, pp. 8-11.

[40] Meaningful comparisons of the physical quantity of different materials that are measured in noncomparable units (tons of iron ore, cubic feet of wood, barrels of cement, etc.) are not possible unless the measurements of quantity are expressed in some common unit of measure. The statistics presently available in which the national consumption of all basic raw materials has been expressed in such a common unit of measure were developed by The President's Materials Policy Commission. The original tables published by the Commission for the period 1900-50 have since been extended to 1952 and republished by the Bureau of the Census (RAW MATERIALS IN THE UNITED STATES ECONOMY, 1900-1952, Washington, D. C., 1954, pp. 91).

In these statistics, the common unit of measure is that quantity of each commodity that could have been purchased for one dollar at 1935-39 national average price. To that common unit of measure the term "constant-dollar quantity unit" has been applied.

For further information on this matter see Chapter V, pp. 3-4.

[41] The 1900-52 trend in relative consumption of lumber is discussed in Chapter V, pp. 8-11.

[42] Chapter V, pp. 11-16.

be drawn from smaller and lower-quality timber and also from logging and mill residues, stumpage-price increase would probably be quite moderate. Advances in technology have already made it possible to utilize logs of lower and lower quality for veneer products. That trend would be expected to act as a brake on the rise of veneer-log stumpage price, but some increase would be expected.[43] For railroad ties (both sawed and hewn), it is doubtful that price increase would have a serious effect upon demand. The same might be true for poles and piling and for the other minor industrial-wood products.

It is probable that these estimates arrived at product-by-product, assuming continued rise in price and continuation of substitution trends, should serve as the lower limit of the range of potential demand against which the timber supply situation be studied.

CHARACTER OF THE UPPER-LEVEL ESTIMATES

Prospective future growth of the nation's population and expanded output of goods and services will most certainly entail an increased intake of basic raw materials.[44] In considering future intake of raw material, it is helpful to break it down into the three major types--food, energy material, and physical-structure material. Substitutions of one material for another go on continually within the confines of each major type. But the possibilities for any extensive substitution of a material of one type for a material of another type are not very important.[45] Energy material cannot be used for food, nor can food be used for production of heat, power, and light. Neither food nor energy materials are suitable to provide the substance of the things we make and use. It is the physical-structure materials that fill this need. The total future requirement for each major type of material can probably be estimated more accurately than for any particular material because for any major type, as a whole, there is practically no substitute. Estimates of the probable future increase in consumption of each major type of material were presented earlier in this chapter.[46]

Industrial Wood

The upper-level estimates of potential demand for timber products are intended to show what the demand for industrial wood[47] might be if that material retained its 1952 place (quantity-wise) in the nation's intake of all physical-structure material. The intake of industrial wood during the period 1941-52 did come very close to keeping step

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[43] Veneer-log stumpage has normally been priced considerably above sawlog stumpage. The lowering of the quality of veneer logs required tends to move their price downward toward sawlog-stumpage price.

[44] The most comprehensive study so far made of the nation's future requirements for basic raw materials is that done by the President's Materials Policy Commission in 1951-52. RESOURCES FOR FREEDOM, Volumes I through V, U. S. Government Printing Office, Washington, D. C., 1952.

[45] One exception to this general statement is the production of certain plastics, synthetic fibers, and synthetic rubber (all physical-structure materials) from derivatives of petroleum and coal which are energy materials. Another (not yet commercially developed) is the production of animal feeds such as fodder yeast and molasses by hydrolysis of wood cellulose. Other examples of this kind could be cited, but taken as a whole, they are not a major factor in estimating raw-material requirements.

[46] See pages 14-17.

[47] Owing to the fact that fuelwood competes only with other energy materials; and that timber products, other than fuelwood, compete only with other physical-structure materials; it is useful in demand analysis to have a convenient designation for timber products other than fuelwood. Following the established practice of the United Nations Food and Agriculture Organization, in its world statistics of timber production and consumption, the term "industrial wood" has been used in this chapter to designate timber products other than fuelwood.

with intake of all other physical-structure material.[48] This occurred in spite of the steep increase in real price of lumber, which comprised from 60 to 65 percent of industrial wood. If the price-disparity between industrial wood and its competing materials should develop no further, there would appear to be a reasonable chance that intake of such wood might continue to parallel the intake of other physical-structure materials.

The upper-level estimates imply no appreciable increase (between 1952 and target dates) in the real price of industrial wood relative to its competing materials. They also imply that any non-price factors which might result in the substitution of other materials for industrial wood (or the opposite substitution) will not produce any net reduction in the uses for such wood.

These upper-level estimates, of course, are not predictions of the 1975 and 2000 consumption of industrial wood; neither are they predictions that there will be no further increase in the real price of industrial wood; nor that industrial wood will actually hold its 1952 competitive position against other materials--insofar as the non-price factors are concerned. What they are intended to be, is an indication of the quantity of industrial wood that would be called for (by 1975 and 2000) if such wood could hold its 1952 position as a basic raw material and share equally with competing materials in the general expansion of materials-intake expected during the next fifty years. It is probable that such estimates should mark the upper limits of the range of potential demand against which the timber supply situation be studied.

These upper-level estimates of potential demand also are useful as a rough indicator of the extent to which increase of real price, and further substitution of other materials for industrial wood, are implicit in the lower-level estimates.

One further reason for making these upper-level estimates is that they are derived directly from estimates of the general expansion of the nation's economy. Previous Forest Service estimates of forward demand for timber products have tended to be too low, probably because insufficient attention was given to the influence of growth of the national economy. Of the several Forest Service estimates of total industrial-wood requirements published so far, the 1946 short-term estimate of 1950-55 average annual requirements is the only one that is anywhere near actual consumption of industrial wood in 1952 (table 14). The 1946 long-term estimate of year - 2000 potential requirements is obviously much too low. That under-estimate, of course, was due in part to the population projections current in 1946. According to present outlook, the United States will have 100 million more people in 2000 than were expected back in 1946.

Fuelwood

Fuelwood is rapidly becoming a byproduct of timber cut for industrial-wood products. In 1952, an estimated 58.6 million cords of wood were used for fuel. Of this total, some 31.4 million cords were taken from plant residues. Of the 27.2 million cords cut directly from trees, some 14.1 million came from dead and cull trees and from trees on noncommercial forest land. The other 13.1 million cords were cut from forest growing stock, but of this, only 6.8 million cords were cut from live trees of sawtimber size.[49] In view of this developing situation, and of the comparatively weak position of fuelwood in competition with other energy materials, only one estimate of potential demand for fuelwood has been made. The upper-level and the lower-level estimates of total potential demand for timber products contain the same fuelwood component.

[48] See Chapter V, pp. 40-42.

[49] Twenty to fifty years ago, fuelwood was a major factor in the cut of commercial timber.

TABLE 14.--Comparison of various Forest Service industrial-wood requirement estimates with 1952 consumption

Name of report or consumption year	Date of report	Target year of requirement estimates	Lumber (board feet lumber tally)	Pulpwood (standard cords)	Veneer logs and bolts (board feet log scale)	Other industrial wood (cubic feet roundwood)[1]	All industrial wood (cubic feet roundwood)[1]
			Million	*Million*	*Million*	*Million*	*Million*
Capper Report[2]	1920	Indefinite future	35,000	--	--	--	--
Clapp-Boyce Report[3]	1924	1950	--	15	--	--	--
Copeland Report[4]	1933	"Normal"	32,000	25	920	1,588	8,687
Hale Report[5]	1935	1950	--	25	--	--	--
Yearbook of Agriculture[6]	1940	Indefinite future	30,000	25	1,390		8,020
Reappraisal Report[7]	1946	1950-55 average	42,500	29	2,400	1,415	10,568
Do	1946	2000	39,000	40	2,400	1,418	10,832
1952 consumption	--	--	41,462	35.4	2,467	699	10,237

[1] Conversion of commercial-unit volume to roundwood volume based throughout on same ratios.

[2] U. S. Dept. of Agriculture. TIMBER DEPLETION, LUMBER PRICES, LUMBER EXPORTS, AND CONCENTRATION OF TIMBER OWNERSHIP, p. 37. 1928.

[3] Clapp, Earle H., and Boyce, Charles W. HOW THE UNITED STATES CAN MEET ITS PRESENT AND FUTURE PULP-WOOD REQUIREMENTS, p. 32. U. S. Dept. Agr. Bul. 1241. 1924.

[4] U. S. Sen. Doc. 12, 73d Cong., 1st Sess. A NATIONAL PLAN FOR AMERICAN FORESTRY, pp. 236-37, 214-15. 1933.

[5] U. S. Sen. Doc. 115, 74th Cong., 1st Sess. NATIONAL PULP AND PAPER REQUIREMENTS IN RELATION TO FOREST CONSERVATION, pp. 25-26. 1935.

[6] Marsh, R. E., and Gibbons, William H. "Forest Resource Conservation" in YEARBOOK OF AGRICULTURE 1940: p. 483. 1940.

[7] U. S. Forest Service. POTENTIAL REQUIREMENTS FOR TIMBER PRODUCTS IN THE UNITED STATES, p. 3. 1946. [Processed]

SUMMARY OF THE LOWER-LEVEL ESTIMATES OF POTENTIAL DEMAND

The 1952 consumption of all timber products and the estimated potential demand--based on a product-by-product analysis assuming a substantial rise in price with continuation of substitution trends--are as follows:[50]

All timber products	Roundwood (Million cu. ft.)	Percent
1952 Consumption	12,245	100
1975 Demand	14,291	117
2000 Demand	18,035	147

These figures, of course, include fuelwood. Because of the special circumstances of fuelwood procurement (even of that which is cut directly from trees--hence included in roundwood volume), the more significant consumption and demand figures are those which pertain to industrial wood, i.e., to timber products other than fuelwood. The 1952 consumption of all industrial wood and the estimated potential demand are as follows:

All industrial wood	Roundwood (Million cu. ft.)	Percent
1952 Consumption	10,237	100
1975 Demand	12,787	125
2000 Demand	17,049	167

Lumber, of course, has long been the major item of industrial wood. But the rapid increase in consumption of pulpwood and of veneer logs and bolts has greatly reduced the dominance of lumber in the industrial-wood picture. The sawlogs from which the lumber consumed in 1952 was cut represented 63 percent of industrial roundwood consumed in that year (fig. 3). The lower-level estimates of potential demand imply that sawlogs for lumber will constitute only 56 percent of industrial-wood demand by 1975 and 50 percent by 2000. The consumption of lumber in 1952 and the estimated potential demand are as follows:[51]

Sawlogs for lumber	Lumber tally (million bd. ft.)	Percent	Roundwood (million cu. ft.)
1952 Consumption	41,462	100	6,419
1975 Demand	46,000	111	7,153
2000 Demand	55,000	133	8,545

[50] Any summation of estimated potential demand for timber products (or of past consumption) involves the problem of choosing a common unit of measurement. The best so far devised for this purpose is the cubic foot of primary roundwood products (logs and bolts) brought out of the forests for commercial use. This roundwood volume, of course, does not include the logging residue left in the forest. It does include log and bolt material that later becomes mill residues, and it includes all such residue whether utilized or not. Roundwood volume includes a considerable quantity of logs and bolts that have been cut from dead and cull trees and from trees on noncommercial forest land.

Unless otherwise noted, the roundwood-volume estimates in this chapter include roundwood volume equivalent of the net imports of lumber, woodpulp, and paper.

[51] These figures include the net imports of lumber and sawlog-equivalent roundwood volume.

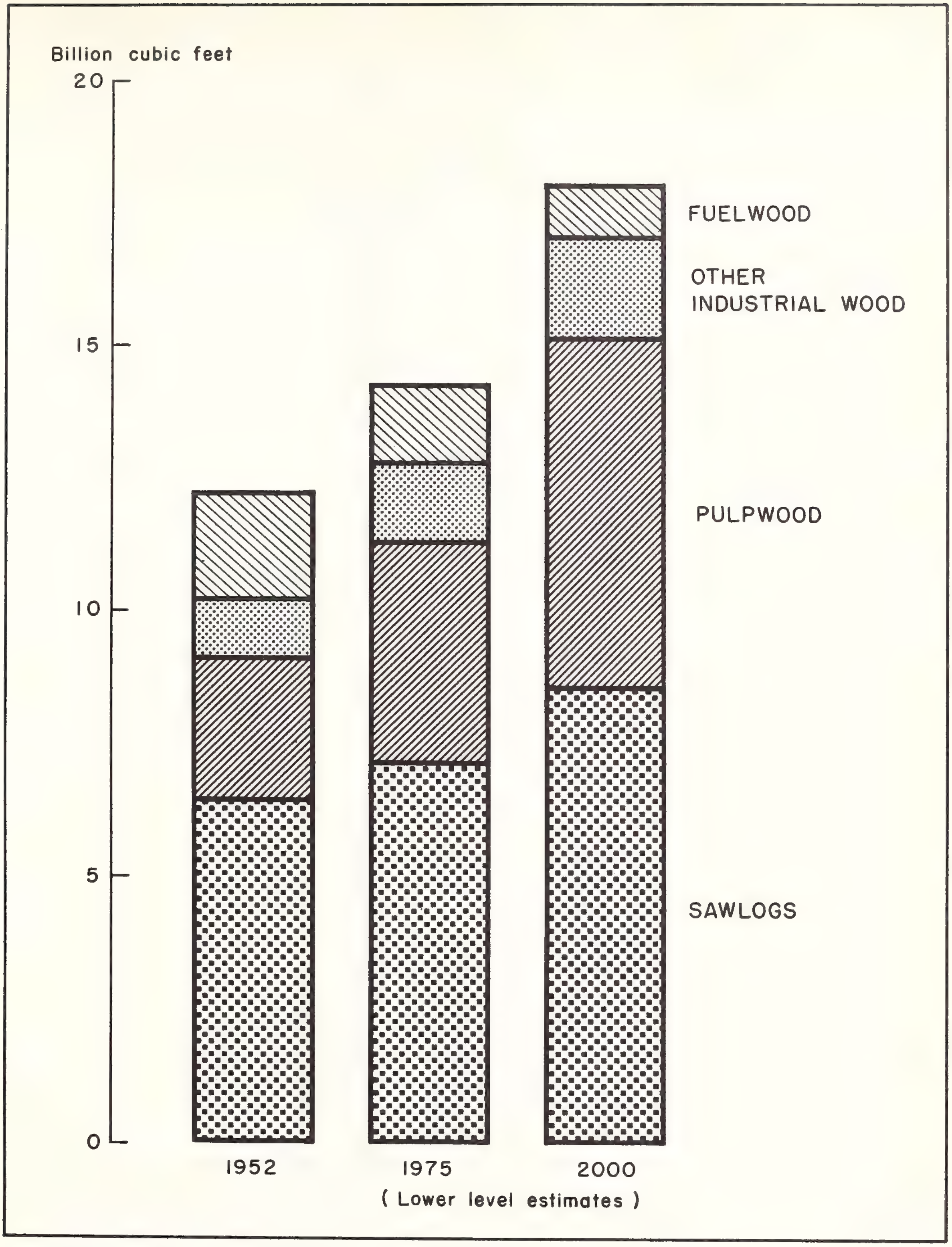

Fig. 3 - Timber products consumption in the United States, 1952, and potential demand.

Consumption of pulpwood has been increasing rapidly for many years. The ever-expanding uses for the various products of woodpulp and wood fiber indicate that demand for pulpwood will continue to increase at a fairly rapid rate. The 1952 consumption of pulpwood (including the pulpwood equivalent of the net imports of wood pulp, paper, and paperboard) are as follows:

Pulpwood	Million cords	Percent	Roundwood (million cu. ft.)
1952 Consumption	35.4	100	2,697
1975 Demand	56.0	158	4,150
2000 Demand	90.0	254	6,606

The pulpwood volume expressed in cords includes mill residues used for pulpwood. The roundwood-volume figures do not include such residues because they are accounted for in the roundwood volume of sawlogs and other primary products from which the residues come.

Consumption of veneer logs and bolts has been increasing rapidly during the past 15 to 25 years. The indications are that demand will continue to increase. Consumption of veneer logs and bolts in 1952 and estimated potential demand are as follows:

Veneer logs and bolts	Log scale (million bd. ft.)	Percent	Roundwood (million cu. ft.)
1952 Consumption	2,467	100	422
1975 Demand	4,500	182	773
2000 Demand	6,500	263	1,114

Other industrial-wood products--minor in the sense that no one of them represents a large volume of wood in comparison with lumber, pulpwood, and veneer--include cooperage logs and bolts, piling, poles, fence posts, hewn ties, round mine timbers, and a miscellaneous assortment of other products. The 1952 consumption of these minor products and the estimated potential demand are as follows:

Minor industrial-wood products	Roundwood (million cu. ft.)	Percent
1952 Consumption	699	100
1975 Demand	711	102
2000 Demand	784	112

Consumption as of 1952 and the 1975 estimated demand for these minor industrial-wood products are shown in table 15 with the breakdown by product class. Quantities are expressed both in the standard units of measure and in roundwood volume. The product-class breakdown was not attempted in the estimate of potential demand for 2000.

Owing to the fact that fuelwood is drawn from so many different sources, any single figure cited as "fuelwood consumption" or "potential demand for fuelwood" is likely to lead to some confusion. Furthermore, there is a possibility of confusion with respect to wood used for fuel by industrial and other nonresidential establishments. Some estimates made in the past have included such wood and others have not. The figures presented in this chapter for total fuelwood consumption, and the estimates of potential demand, do include that used by nonresidential establishments as well as that used in homes.

TABLE 15.--Estimated domestic consumption of timber products in 1952, and estimated (lower-level) potential demand, 1975 and 2000

Product	Standard units of measure	Domestic consumption 1952		Potential-demand estimates			
				1975		2000	
		Number of units[1]	Roundwood[2]	Number of units[1]	Roundwood[2]	Number of units[1]	Roundwood[2]
		Million	*Million cu. ft.*	*Million*	*Million cu. ft.*	*Million*	*Million cu. ft.*
Sawlogs for lumber[3]	Bd. ft. lumber tally	41,462	6,419	46,000	7,153	55,000	8,545
Veneer logs and bolts	Bd. ft. log scale	2,467	422	4,500	773	6,500	1,114
Pulpwood[4]	Standard cords	35.4	2,697	56	4,150	90	6,606
Cooperage logs and bolts	Bd. ft. log scale	355.3	73	400	82		
Piling	Linear feet	41.2	28	40	27		
Poles	Pieces	6.5	88	5	68		
Posts, round and split	Do.	306	194 } 699	280	178 } 711	Not allocated to product	784
Hewn ties	Do.	10.2	67	3	19		
Mine timbers, round	Cubic feet	81	81	130	130		
Other industrial wood	Do.	227	168	280	207		
All industrial wood[5]	--	--	10,237	--	12,787	--	17,049
Fuelwood	Standard cords	[6] 58.6	[7] 2,008	[6] 40	[7] 1,504	[6] 30	[7] 986
All timber products	--	--	12,245	--	14,291	--	18,035

[1] Includes net imports and volume of products recovered from mill residues.
[2] Includes roundwood-equivalent of net imports of lumber, woodpulp and paper. Includes roundwood volume cut from dead and cull trees. Excludes volume of products recovered from mill residues. Excludes 1 billion bd. ft. of re-use lumber, 1975 and 2000.
[3] Includes sawed timbers and sawed ties.
[4] Includes pulpwood net imports and pulpwood-equivalent of net imports of woodpulp and finished paper.
[5] All timber products excluding fuelwood.
[6] For industrial as well as home use. Includes mill residues used for fuel.
[7] Includes only the volume cut directly from trees, including dead and cull trees.

Consumption of wood used for fuel and the estimated potential demand, broken down by principal sources are shown in table 16. In summary, those estimates and the corresponding percentage changes are as follows:

Fuelwood		1952 Consumption	1975 Demand	2000 Demand
Total, all sources	Million cords	58.6	40	30
	Percent	100	68	51
Roundwood	Million cu. ft.	2,008	1,504	986
	Percent	100	75	49
Growing stock	Million cu. ft.	965	696	448
	Percent	100	72	46

The estimates discussed above are consolidated in table 15. Attention is now directed to consideration of these lower-level estimates in terms of per capita consumption and in terms of relative consumption.

TABLE 16.--Consumption of fuelwood in 1952 and estimated potential demand, by principal sources

Source	1952 consumption		Potential demand			
			1975		2000	
	Cords	Roundwood	Cords	Roundwood	Cords	Roundwood
	Thousand	*Million cu. ft.*	*Thousand*	*Million cu. ft.*	*Thousand*	*Million cu. ft.*
All sources	58.6	--	40.0	--	30.0	--
Mill residues	31.4	--	19.6	--	16.7	--
Roundwood:	27.2	2,008	20.4	1,504	13.3	986
Not from growing stock	14.1	1,043	10.9	808	7.2	538
From growing stock:	13.1	965	9.5	696	6.1	448
Live sawtimber trees[1]	6.8	500	5.2	381	3.4	250
Live poletimber trees	6.3	465	4.3	315	2.7	198

[1] In terms of board-foot volume (log scale) cut from sawlog material of live sawtimber, the 1952 consumption was 2,246 million board feet. Potential demand is estimated at 1,635 million board feet by 1975 and 1,077 million by 2000.

LOWER-LEVEL ESTIMATES IN TERMS OF PER CAPITA CONSUMPTION

While the lower-level estimated potential demands for timber products are substantially above 1952 consumption, they actually imply that timber products will be used much more sparingly in the future than in the past. The consumption increase implied is less (percentage-wise) than the expected increase of the Nation's population--34 percent in the 1952-75 period and 75 percent in the 1952-2000 period. That, of course, would mean a decline in per capita average consumption of timber products.

The changes in the index of per capita average consumption (1952 = 100.0) would be as follow:

	Index of per capita consumption		
	1952	1975	2000
All timber products	100.0	87.2	84.1
Industrial wood	100.0	93.4	95.1
Lumber	100.0	82.9	75.7
Pulpwood	100.0	117.4	143.5
Veneer logs	100.0	136.4	150.5
Minor products	100.0	76.2	64.0
Fuelwood	100.0	51.4	29.7

For lumber, the major industrial-wood product, the lower-level estimates imply a 17.1 decrease in per capita consumption by 1975 and a 24.3 percent decrease by 2000. For pulpwood, on the other hand, the estimates imply an increase of 17.4 percent by 1975 and 43.5 percent by 2000. The increases in veneer-log per capita consumption would be 36.4 and 50.5 percent respectively. For industrial wood as a whole the decrease would be 6.6 percent by 1975 and 4.9 percent by 2000. For all timber products the decrease would be 12.8 percent by 1975 and 15.9 percent by 2000.

From the standpoint of national policy, a decrease in the per capita average consumption of a raw material, as important to the economy as industrial wood, may be a matter of some concern. Continuation of national economic growth, with a general rise in the standards of living on the pattern of the past half century, would require an increase--not a decrease--in per capita average consumption of basic raw materials.

There appears to be ample reason to expect that the rate of increase in per capita average consumption of basic raw materials, which characterized United States economic growth over the past half century, will continue through the next 50 years. Any other surmise would involve the notion that this Nation is approaching the zenith of the rise in its standard of living; convincing evidence in support of such a view would indeed be difficult to cite.

What seems most likely is that economic growth (output of goods and services and rising standards of living) will continue to follow the trend of the past. If so, the per capita average consumption of physical-structure material (which embraces industrial wood) could be expected to increase about 13.5 percent during the period 1950-75 and about 27.5 percent during the period 1950-2000. Converting such increases to total intake in 1975 (assuming a population of 210 million), and to total intake in 2000 (assuming a population of 275 million), and shifting the base year from 1950 to 1952, indicates that demand for physical structure material as a whole would increase by approximately 40 percent in the period 1952-75 and by 105 percent in the period 1952-2000.[52] In terms of quantity, the intake of all physical-structure material would increase from 5,933 million constant-dollar quantity units in 1952 to 8,280 million by 1975 and to 12,175 million by 2000.

The consumption (implied in the lower-level estimates) of industrial-wood products in relation to the prospective consumption of all physical-structure material has been expressed in terms of a "relative consumption index," using the 1952 relationship as the base. The results of that analysis are as follow:[53]

	Index of relative consumption		
	1952	1975	2000
All industrial wood	100	90	81
Lumber	100	80	65
Pulpwood	100	113	124
Veneer logs	100	131	128
Minor products	100	73	55
Fuelwood	100	41	18

Stated in another way, the lower-level estimates of potential demand for timber products imply that the consumption of industrial wood will have lagged behind the intake of all physical-structure material by 10 percent in 1975 and by 19 percent in 2000. Lumber will have lagged 20 percent by 1975 and 35 percent by 2000. Pulpwood, on the other hand, will have run ahead of physical-structure material consumption by 13 percent in 1975 and by 24 percent in 2000. Veneer-log consumption would be 31 percent ahead by 1975 and 28 percent by 2000. The minor products would lag most of all--27 percent by 1975 and 45 percent by 2000.

Relative consumption of fuelwood has been computed on the basis of the prospective future intake of energy material as a whole. The lag in this case would be 59 percent by 1975 and 82 percent by 2000.

That 1975 demand for lumber would be satisfied at 80 percent of 1952 relative consumption without a 25 to 30 percent real-price increase in relation to competing materials

[52] The procedure by which these projections were made is shown in a later section summarizing the high-level estimates of potential demand.

[53] The validity of the analysis depends, of course, on the reliability of the projections of physical-structure material intake. Judging from data for the years 1951 and 1952, the projections are more likely to be lower than actual intake will be than they are to be too high.

appears to be rather improbable. This same observation applies to year-2000 demand at 65 percent of 1952 relative consumption, except that the real price increase might be between 40 and 50 percent.

With lumber price leading the way, the real-price increase for industrial wood as a whole might be of the order of 15 to 20 percent by 1975 and of the order of 25 to 30 percent by 2000.

These inferences regarding the real-price increase implicit in the lower-level estimates of potential demand are based on the price-consumption analysis presented in Chapter V.

LOWER-LEVEL ESTIMATES IN TERMS OF DEMAND ON DOMESTIC FORESTS

The estimates of 1952 consumption and of potential demand summarized above include net imports of lumber, pulpwood, woodpulp, paper, and paperboard. In order to arrive at estimates of the implied demand on the domestic forests, it is necessary to deduct the anticipated net imports.

Anticipated Net Imports

The United States, for some years, has been the world's largest importer of timber products. It is to be expected that importations will continue. The 1952 net imports and the anticipated net imports for 1975 and 2000 are as follow:

	Lumber (million bd. ft.)	Pulpwood and pulpwood equivalent (million cords)	Veneer logs and veneer-log equivalent (million bd. ft.)
1952 Net imports	1,752	11.2	--
1975 Anticipated	1,000	14.0	--
2000 Anticipated	1,000	14.0	500

These estimates of future net imports are, of course, a matter of judgment. It is possible that they could be larger, but in view of the prospective needs for softwood lumber in the under-developed parts of the Free World and the limited supply of it outside the Soviet sphere, it appears safer not to count on any increase of imports into the United States.

With respect to pulpwood a 25 percent increase of net imports has been assumed. Most of this would be in the form of woodpulp and finished paper--chiefly newsprint. Canada has the largest supply of species most suitable for newsprint, and it is most likely that the expanding United States demand will be met chiefly from that source for some time to come.

The mounting demand for plywood and other veneer products makes it appear that the United States will, in time, begin to import veneer logs. The most likely source of foreign supply is the tropical forests of Latin America, Africa, and Southeast Asia. No allowance for such imports has been made for 1975, but for 2000 it has been assumed that there will be a net import of 500 million board feet of tropical hardwood.

The 1952 net imports of timber products and the anticipated net imports, in terms of roundwood volume are as follows:

	Lumber	Pulpwood	Veneer	Total	Percent
	(million cu. ft.)	(million cu. ft.)	(million cu. ft.)	(million cu. ft.)	(million cu. ft.)
1952 Net imports ----	273	874	--	1,147	100
1975 Anticipated-----	156	1,092	--	1,248	109
2000 Anticipated-----	156	1,092	95	1,343	117

For net imports as a whole, it has been assumed that there will be a net increase of 9 percent during the period 1952-75, and an increase of 17 percent during the period 1952-2000.

Demand on Domestic Forests

Deducting the anticipated net imports from estimated total demand for timber products, the resulting requirement from domestic forests would be as follows:

	Roundwood (million cu. ft.)		
All timber products	1952	1975	2000
All species -------------------------	11,098	13,043	16,692
Percent -------------------------	100	118	150
Softwood ----------------------	7,522	8,810	11,307
Percent ----------------------	100	117	150
Hardwood ----------------------	3,576	4,233	5,385
Percent ----------------------	100	118	151

While a large increase in the demand for hardwood industrial wood is included in these lower-level estimates, that increase is almost offset by the anticipated decrease in the demand for fuelwood. However, since more than half of the roundwood cut for fuelwood would presumably not come from forest growing stock, the hardwood demand outlook is much better than the figures above might suggest.

The estimates of industrial-wood requirement have a very different aspect:

	Roundwood (million cu. ft.)		
All industrial wood	1952	1975	2000
All species -------------------------	9,090	11,539	15,706
Percent -------------------------	100	127	173
Softwood ----------------------	7,046	8,532	11,045
Percent ----------------------	100	121	157
Hardwood ----------------------	2,044	3,007	4,661
Percent ----------------------	100	147	228

Industrial wood is cut chiefly from forest growing stock. It is these figures and percentage increases that are the most important.

The indicated demands on domestic forests for lumber are as follows:

Lumber	Lumber tally (million bd. ft.)		
	1952	1975	2000
All species	39,510	45,000	54,000
Percent	100	114	137
Softwood	31,507	35,030	40,030
Percent	100	111	127
Hardwood	8,003	9,970	13,970
Percent	100	125	175

The shift toward hardwood lumber is predicated chiefly on indications that it has been more successful in resisting the competition of other materials than has softwood lumber. Hardwood lumber is used for flooring, furniture, and other manufactured products for which wood is a preferred material.

The lower-level demand estimates indicate the following requirements for pulpwood from domestic sources:

Pulpwood	Roughwood basis (million cords)		
	1952	1975	2000
All species	25.1	42.0	76.0
Percent	100	167	303.0
Softwood	21.4	32.0	52.7
Percent	100	150	246
Hardwood	3.7	10.0	23.3
Percent	100	270	630

The estimated rapid increase of demand for hardwood pulpwood is based on the expectation that technological developments in hardwood pulp manufacture--already well advanced--will develop much further. Rising price of softwood sawlog stumpage will also be a potent factor in forcing increased use of hardwood for pulp throughout the eastern part of the Nation.

The estimated demand for domestic veneer logs and bolts is as follows:

Veneer logs	Log scale (million bd. ft.)		
	1952	1975	2000
All species	2,467	4,500	6,000
Percent	100	182	243
Softwood	1,548	2,700	4,000
Percent	100	174	258
Hardwood	919	1,800	2,000
Percent	100	196	218

While these estimated increases in demand for plywood and other products of veneer are large (percentagewise), consumption has been growing very rapidly for some time. New

facings of plywood consisting of paper and various other materials are almost sure to expand uses of plywood even more. A part of the increase in demand for plywood will, of course, be as a substitute for lumber.

No net imports of the minor industrial-wood products are anticipated. The demand on domestic forests would be the same as shown previously, but the softwood-hardwood distribution is of interest here.

Minor products	Roundwood (million cu. ft.) 1952	1975	2000
All species	699	711	784
Percent	100	102	112
Softwood	326	310	353
Percent	100	95	108
Hardwood	373	401	431
Percent	100	108	116

The minor industrial-wood products are itemized in standard units and in roundwood volume for 1952 and 1975 in table 17. The year-2000 estimate is for total only.

The estimated fuelwood demand was discussed on pages 46-47. The tabulation below shows softwood-hardwood distribution of fuelwood cut directly from trees (roundwood) and of fuelwood cut from forest growing stock.

Fuelwood	Roundwood (million cords) 1952	1975	2000
All roundwood	27.2	20.4	13.3
Softwood	6.2	3.6	3.4
Hardwood	21.0	16.8	9.9
Growing stock	13.1	9.5	6.1
Softwood	3.2	2.0	1.9
Hardwood	9.9	7.5	4.2

In table 17, the estimates that have been summarized in this section are brought together.

Demand on Domestic Forests in Terms of Timber Cut

The timber volume estimates so far discussed have dealt in standard units of product and in the volume of the primary roundwood products. The next step is to indicate the volumes of forest growing stock and of sawtimber that would have to be cut to meet those demands on the domestic forests. This raises the question of how much improvement there is likely to be in logging utilization.

Such improvement is a matter of obtaining more marketable material with less depletion of the forest growing stock and of its sawtimber component. The measures being used to attain that objective include increased utilization of dead and cull trees, increased utilization of material that formerly was left in the woods as logging residues, and increased utilization of material of less than sawtimber size. Although not a matter of logging utilization, there is also the possibility of increased utilization of trees from

TABLE 17.--Domestic output of timber products in 1952, and lower level estimates of potential demand on domestic forests in 1975 and 2000

Product and species group	Standard unit of measure	Out in standard units[1] 1952	Potential demand 1975	Potential demand 2000	Output of roundwood[2] 1952		Potential demand 1975		Potential demand 2000
		Million	*Million*	*Million*	*Million cu. ft.*		*Million cu. ft.*		*Million cu. ft.*
Sawlogs for lumber:									
Total	Bd. ft. lumber tally	39,510	45,000	54,000	6,146		6,997		8,389
Softwood	do.	31,507	35,030	40,030	4,921		5,471		6,251
Hardwood	do.	8,003	9,970	13,970	1,225		1,526		2,138
Pulpwood:									
Total	Cords	25.1	42.0	76.0	1,823		3,058		5,514
Softwood	do.	21.4	32.0	52.7	1,550		2,317		3,798
Hardwood	do.	3.7	10.0	23.3	273		741		1,716
Veneer logs and bolts:									
Total	Bd. ft. log scale	2,467	4,500	6,000	422		773		1,019
Softwood	do.	1,548	2,700	4,000	249		434		643
Hardwood	do.	919	1,800	2,000	173		339		376
Cooperage logs and bolts:									
Total	Bd. ft. log scale	355.3	400		73		82		
Softwood	do.	117.9	112		26		25		
Hardwood	do.	237.4	288		47		57		
Piling:									
Total	Linear feet	41.2	40		28		27		Not itemized by product
Softwood	do.	37.9	36		26		25		
Hardwood	do.	3.3	4		2		2		
Poles:									
Total	Pieces	6.5	5		88		68		
Softwood	do.	6.4	5	Not itemized by product	87		68		
Hardwood	do.	0.1	--		1		--		
Posts, round and split:									
Total	Pieces	306.0	280		194	699	178	711	784
Softwood	do.	103.3	90		69	326	60	310	353
Hardwood	do.	202.7	190		125	373	118	401	431
Hewn ties:									
Total	Pieces	10.2	3.0	See roundwood columns	67		19		
Softwood	do.	3.7	1.2		23		7		
Hardwood	do.	6.5	1.8		44		12		
Mine timbers, round:									
Total	Cubic feet	81.0	130		81		130		
Softwood	do.	18.5	30		19		30		
Hardwood	do.	62.5	100		62		100		
Other industrial wood:									
Total	Cubic feet	[3] 227.0	[3] 280		168		207		
Softwood	do.	112.3	140		76		95		
Hardwood	do.	114.7	140		92		112		
All industrial wood:									
Total	Cubic feet	--	--	--	9,090		11,539		15,706
Softwood	do.	--	--	--	7,046		8,532		11,045
Hardwood	do.	--	--	--	2,044		3,007		4,661
Fuelwood:									
Total	Cords	58.6	40	30.0	2,008		1,504		986
Softwood	do.	31.1	18	17.0	476		278		262
Hardwood	do.	27.5	22	13.0	1,532		1,226		724
All timber products:									
Total	Cubic feet	--	--	--	11,098		13,043		16,692
Softwood	do.	--	--	--	7,522		8,810		11,307
Hartwood	do.	--	--	--	3,576		4,233		5,385

[1] Figures for individual products include mill residues utilized for that purpose.
[2] Figures for individual products are output from roundwood only including that cut from dead and well trees and from trees on noncommercial forest land.
[3] The difference between this volume and the corresponding roundwood volume is the mill residues that were utilized for these products in 1952 and may be so utilized in 1975.

land not classed as commercial forest. Anticipating that progress on this front will be sustained throughout the next fifty years, the estimated demand on domestic forests has been adjusted downward by substantial amounts.[54]

With due allowance made for improvement in logging utilization, the cut from domestic forests indicated by the lower-level demand estimates would be as shown in table 18.

TABLE 18.--Timber cut from growing stock and from live sawtimber, 1952 and estimated lower-level potential demand on domestic forests, 1975 and 2000

Product and species group	Growing stock			Live sawtimber		
	1952	Estimated demand		1952	Estimated demand	
		1975	2000		1975	2000
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*
Sawlogs for lumber:						
Total	6,821	7,650	9,309	36,636	41,191	49,256
Softwood	5,214	5,688	6,565	28,890	31,791	36,220
Hardwood	1,607	1,962	2,744	7,746	9,400	13,036
Pulpwood:						
Total	1,727	2,502	3,963	4,693	5,877	9,810
Softwood	1,460	1,869	2,635	4,252	5,006	8,063
Hardwood	267	633	1,328	441	871	1,747
Veneer logs and bolts:						
Total	492	900	1,164	2,803	5,097	6,610
Softwood	251	416	624	1,575	2,615	3,866
Hardwood	241	484	540	1,228	2,482	2,744
Minor products:						
Total	713	679	773	2,462	2,190	2,255
Softwood	319	286	348	1,234	1,105	1,088
Hardwood	394	393	425	1,228	1,085	1,167
All industrial wood:						
Total	9,753	11,731	15,209	46,594	54,355	67,931
Softwood	7,244	8,259	10,172	35,951	40,517	49,237
Hardwood	2,509	3,472	5,037	10,643	13,838	18,694
Fuelwood:						
Total	1,004	696	448	2,246	1,635	1,077
Softwood	243	144	136	595	343	323
Hardwood	761	552	312	1,651	1,292	754
All timber products:						
Total	10,757	12,427	15,657	48,840	55,990	69,008
Softwood	7,487	8,403	10,308	36,546	40,860	49,560
Hardwood	3,270	4,024	5,349	12,294	15,130	19,448

The cut of growing stock would increase from 10,757 million cubic feet in 1952 to 12,427 million by 1975 and to 15,657 million by 2000. Industrial-wood products cut would increase from 9,753 million in 1952 to 11,731 million by 1975 and to 15,209 million by 2000.

The cut of live sawtimber would increase from 48,840 million board feet in 1952 to 55,990 million by 1975 and to 69,008 million by 2000. Industrial wood accounted for 46,594 million board feet in 1952. By 1975 it would increase to 54,355 million board feet and by 2000 to 67,931 million.

Attention will now turn to the lower-level analysis of potential demand.

[54] Discussion of this adjustment appears in the opening section of Chapter VII.

LOWER-LEVEL POTENTIAL DEMAND ESTIMATES IN DETAIL

The lower-level estimates of potential demand for timber products, summarized above, were developed on the basis of the product-by-product analysis presented in this section. Because the three major industrial-wood products (lumber, pulpwood, and veneer logs) comprise so large a part of the total, a further breakdown of these three by principal end-uses is desirable.

Potential demand for lumber has been subdivided into three main categories: (1) lumber for construction, (2) lumber for use in manufacture, and (3) lumber for use in shipping of other commodities. The construction-use category has been further subdivided into: (a) all new residential construction, (b) all new nonresidential construction except railroad and farm, (c) maintenance-and-repair construction except railroad and farm, (d) new and maintenance-repair construction by railroads, (e) nonresidential new and maintenance-repair construction on farms (fig. 4).

Potential demand for pulpwood products has been broken down into four segments: (1) paper and paper products, (2) paperboard and paperboard products, (3) nonpaper products of woodpulp, and (4) miscellaneous wood-fiber products.

Potential demand for veneer products has been considered in three segments: (1) plywood used in construction, (2) plywood and veneer products used for shipping purposes, and (3) veneer products used in manufacture.

The various other classes of timber products considered separately include: (1) cooperage logs and bolts, (2) piling, (3) poles, (4) fence posts, (5) hewn railroad ties, (6) round and split mine timbers, (7) all other industrial wood, and (8) fuelwood.

ESTIMATES OF POTENTIAL DEMAND FOR LUMBER

The estimates of potential demand for lumber were developed by analysis of its major end-uses. The intensity of treatment, unfortunately, is much less uniform than would be desirable because of the lack of adequate basic information on the volume of lumber consumed in a number of important end-uses.

New Residential Construction

The future annual requirement (and prospective economic demand) for new dwelling units, both nonfarm and farm, has been estimated as follows:

Year	Thousand units
1960	1,300
1965	1,600
1970	1,900
1975	2,200
2000	2,400

Translation of the estimated potential demand for new housing into corresponding potential demand for lumber that might be used in its construction involves the problem of estimating what the average lumber content per dwelling unit might be.

Estimates of average lumber content per dwelling unit built at various times from 1900 to 1953 have been made by a number of agencies. Such estimates have been based on sampling surveys of one kind or another. The results are summarized in table 19.

One problem in the interpretation of these lumber-content estimates is that no two of them are strictly comparable. Those made by Stanford Research Institute are the average for all dwelling units with housekeeping facilities and include detached garages and

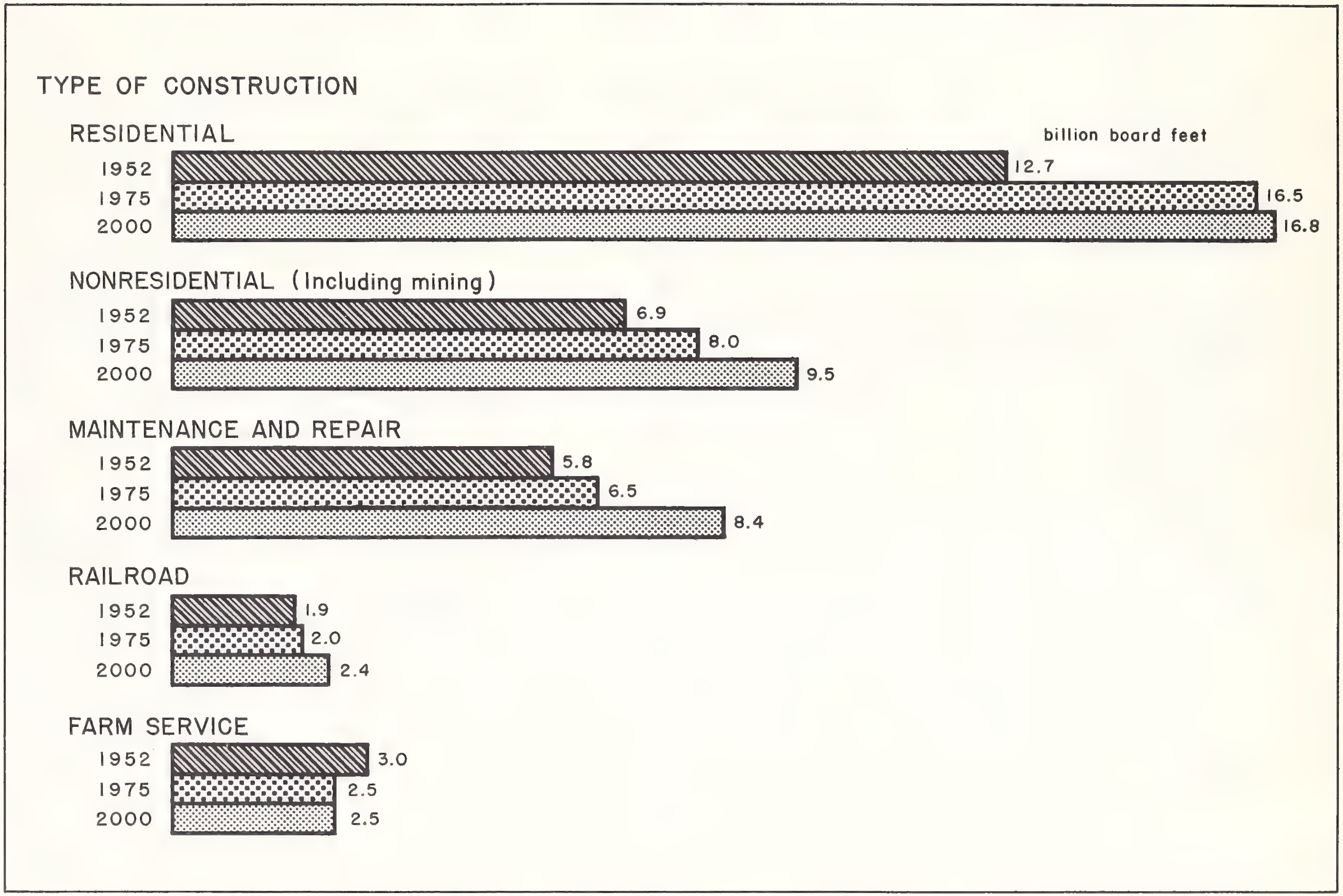

Fig. 4 – Lumber consumed in construction, 1952, and potential demand, 1975 and 2000

TABLE 19.--Summary of various estimates of average lumber content per dwelling unit constructed at specified times

Agency	Year to which estimate applied	Lumber content per unit		
		Single-unit structures	Multiunit structures	Average, all structures
		Board feet	*Board feet*	*Board feet*
Forest Service[1]	About 1900	18,200	10,000	17,400
Stanford Research Institute[2]	1920	--	--	18,900
Forest Service[1]	1920-29	--	--	14,200
Stanford Research Institute[2]	1930	--	--	15,400
Stanford Research Institute[2]	1940	--	--	13,900
Housing and Home Finance Agency[3]	1950	10,500	--	--
Stanford Research Institute[2]	1950	--	--	11,700
Stanford Research Institute[2]	1953	--	--	10,500

[1]U. S. Forest Service. LUMBER REQUIREMENTS FOR NONFARM RESIDENTIAL STRUCTURES, U. S. Dept. Agr. Misc. Pub. 347, p. 17. 1939. These estimates may include lumber used for detached garages and other accessories. The report is not clear on this matter.

[2]Stanford Research Institute. AMERICA'S DEMAND FOR WOOD, 1929-1975, p. 35. Weyerhauser Timber Co., Tacoma, Wash. 1954. These estimates all contain lumber used for detached garages and other accessories.

[3]U. S. Housing and Home Finance Agency. MATERIALS, USE SURVEY, pp. 18-19. 1953. Excludes lumber used in construction of detached garages, porches, and other accessories.

other accessories built at the time the dwelling was constructed. The estimate of the U. S. Housing and Home Finance Agency, applies only to single-family houses built in the first half of 1950 and excludes detached garages and accessories. The Stanford Research Institute study indicates that the volume of lumber used in such accessories in 1953, averaged about 400 board feet per dwelling unit.[55]

A complication arises from the fact that multi-unit structures generally contain much less lumber than single-unit houses. But this factor is now of much less importance than formerly. Judging from the data available for 1954, not more than 10 percent of the total (nonfarm and farm) dwelling units built in that year were in multi-unit structures. Even though multi-unit structures may average one-half the lumber content of single-unit structures, at 10 percent of the total units built, they would lower the overall average lumber content by only 5 percent. This is not enough to be of major concern.

Taking these considerations into account, it seems more than likely that the average lumber content of dwelling units in 1952, including garages and other accessories included in the original building job, was about 10,000 board feet. That volume is apparently between 50 and 60 percent of average lumber content of dwelling units built 30 years ago.

The question of what the average lumber content is likely to be in the future is rather complicated. A substantial part of the decrease in average lumber content per dwelling unit during the past thirty years has been due not to displacement of lumber by other materials but to decrease in the average size of unit[56] and to the elimination of porches and other accessories. Those trends have now probably run their full course.

[55] AMERICA'S DEMAND FOR WOOD, 1929 - 1975, Page 35. This, of course, is an overall average which includes many units that have no garage or other accessories.

[56] Stanford Research Institute estimates that the average cubic-foot content of dwelling units decreased by 32 percent in the period 1920 - 1953. See AMERICA'S DEMAND FOR WOOD, 1929 - 1975. Page 30.

Because of the larger families that are now more common than ten to twenty years ago, there is little probability of further reduction in average size of unit. In fact, there is more likelihood that the average size of unit will increase somewhat.

The other major cause of the decrease in the average lumber content per dwelling unit has been the displacement of lumber by plywood, wood-fiber board, paperboard, and various nonwood materials. That, of course, has been due to the continuing increase of lumber's real price and to various other factors. In these product-by-product estimates of potential demand, it has been assumed that such factors will continue to operate as they have during the past twenty to thirty years. On that basis, the average lumber content per dwelling unit would be expected to decrease to a considerable extent by 1975 and still further by 2000. How much that decrease might be is very much a matter of judgment.

The most intensive analysis of architectural and other trends that have a bearing on this matter is the one done by Stanford Research Institute. On the basis of its study, the Institute has estimated average lumber content as follows:[57]

Year	Per dwelling units (board feet)
1953	10,500
1960	9,950
1965	9,600
1970	9,100
1975	8,700

These Stanford Research Institute estimates of future average lumber content, assuming a further substantial increase of real price of lumber and continuing competition by substitute materials, seem to be rather high--especially for 1960. For purposes of the present study, lumber-content factors considerably lower have been used. These are as follow:

Year	Per dwelling units (board feet)
1952	10,000
1960	9,000
1965	8,500
1970	8,000
1975	7,500
2000	7,000

The assumed virtual stabilization of average lumber-content per unit after 1975 rests on the assumption that the annual demand for new housing (as reflected by the population projections used in this study) would also be stabilized. That assumption, as previously noted, may or may not be valid. If demand for new housing should continue to increase fairly rapidly after 1975 by reason of sustained high birthrates, there would probably be a larger decrease of average lumber content per dwelling unit. With more dwelling units required, however, the total demand for lumber might be not less than for the stabilized situation. Conceivably, it might be higher.

Using the lumber-content factors mentioned above, the estimates of potential lumber demand for new housing at specified future dates would be as follows:

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[57] AMERICA'S DEMAND FOR WOOD, 1929 - 1975, Page 35.

Year	Billion bd. ft.
1952	12.7
1960	11.7
1965	13.6
1970	15.2
1975	16.5
2000	16.8

These estimates include detached garages and other accessories normally a part of the initial building job.

New Nonresidential Construction, Excluding Railroad and Farm

Estimates of 1975 and year-2000 expenditures for new nonresidential construction, consistent with the population and gross national product assumptions of this study, were presented above. Those estimates ($35 billion and $60 billion respectively) provide a basis for the estimates of potential demand for lumber that might be used in such construction. While it is true that estimates based on material-use per dollar of expenditure are subject to rather wide margins of error, the information presently available precludes the use of estimating methods that would give better results.

The U. S. Department of Commerce, from time to time, has made studies and limited field surveys of the quantities of various types of materials used in the several types of construction. Wartime experience, when most materials were under allocation control, has also been a source of information. The Department's latest estimates of quantities of materials used in construction are for 1950.[58] Those estimates, for purposes of the present study, have been converted to board feet per dollar of expenditure and adjusted to take account of construction-cost changes between 1950 and 1953.[59]

The quantities of lumber used per dollar of construction expenditure (at the 1953 construction costs) are estimated as follows:

Class of construction	Board feet per dollar
Private:	
Industrial buildings[1]	0.285
Commercial buildings	.368
Other nonresidential buildings	.370
Public utilities other than railroad	.250
All other private	.015
Public:	
Public buildings	.267
Military facilities	.718
Highways	.171
Sewer and water	.204
Public service enterprises	.147
Conservation and development	.203
All other public	.170
Weighted average:	.290

[1] Includes publicly owned industrial buildings such as atomic energy facilities.

[58] CONSTRUCTION AND CONSTRUCTION MATERIALS, August 1950, Pages 9 - 13.

[59] This adjustment has been made by use of the Department of Commerce implicit deflators used to convert current annual expenditures for various kinds of construction to a constant-dollar basis.

On the basis of these factors and the Department of Commerce estimates of construction expenditure (table 10, page 32) the quantity of lumber used in new nonresidential construction, other than railroad and farm, in 1952 is estimated at 6,000 million board feet.[60]

Technological and other changes in nonresidential construction in the past fifty years have certainly resulted in drastic reductions in lumber-use per dollar of construction expenditure. Some of those changes were discussed in Chapter V. Looking to the future, on the assumption that there will be a continuation of the upward trend in real price of lumber, it would be expected that lumber-use per dollar of expenditure will decrease still further. There is, however, a probability that such decrease, percentagewise, may be less drastic than it has been in the past for the reason that substitution of other materials for present uses of lumber may be more difficult. Stanford Research Institute, in a survey of 1,000 large nonresidential contractors, has found that lumber now used in nonresidential construction is distributed as follows:[61]

Use	Percent
Concrete forms	58
Framing and trim	20
Scaffolding	10
Bracing, shoring, decking	9
Temporary buildings, skids, and other uses	3
Total	100

While plywood and hardboard are used extensively as surface materials in concrete forms, neither one takes the place of lumber as framing and bracing material in concrete forms. This is one indication of the difficulties that may be encountered in further drastic substitution of other materials for lumber in nonresidential construction.

The choice of lumber-use factors that might be applicable in nonresidential construction in 1975 and in 2000 is inevitably a matter of judgment. For purposes of the present study, it is assumed that there will be a uniform reduction of 30 percent during the period 1953 - 1975 and a reduction of 55 percent during the period 1953 - 2000. On that basis, the future factors would be:

[60]The Stanford Research Institute estimate of 1953 lumber consumption in nonresidential construction (including railroad but not farm) is considerably higher--7,213 million board feet. The inclusion of railroad construction would account for only a small part of this difference in estimates.

The 1953 lumber-use factors used by the Institute were based on its own survey of nonresidential construction. Some of the Institute's factors appear to be on the high side (AMERICA'S DEMAND FOR WOOD, 1929 - 1975, Page 43). It is difficult, for example, to understand why construction of hospital and other institutional buildings would absorb 0.400 board feet per dollar while educational buildings would absorb only 0.295 board feet. It is equally difficult to conceive how highway construction would absorb almost as much per dollar of expenditure as educational buildings--0.277 board feet against 0.295. The corresponding factors based on Department of Commerce data are: hospital and other institutional, 0.124; educational buildings, 0.321; highways, 0.171.

[61]AMERICA'S DEMAND FOR WOOD, 1929 - 1975, Page 42.

Class of construction	Board feet per dollar 1975	2000
Private:		
Industrial buildings	0.200	0.128
Commercial buildings	.258	.166
Other nonresidential buildings	.259	.167
Public utilities	.175	.113
All other private	.011	.007
Public:		
Public buildings	.187	.120
Military facilities	.503	.323
Highways	.120	.077
Sewer and water	.143	.092
Public service enterprises	.103	.066
Conservation and development	.142	.091
All other public	.119	.077
Weighted average	.203	.131

Application of these factors to estimated expenditures for new nonresidential construction in 1975 and 2000 (table 11, page 35) indicates a potential lumber demand of about 7,000 million board feet by 1975[62] and about 8,000 million by the year 2000.

Maintenance and Alteration of Residential Structures

Expenditures for maintenance, repair, alteration, and additions to residential structures (including farm residences) has been estimated above at:

Year	Billion dollars
1953	6.6
1975	9.3
2000	13.0

Translation of the expenditure estimates into potential demand for lumber that might be used for these purposes involves application of lumber-use-per-dollar factors. Very little survey work has yet been done in this field of lumber use. Consequently, any factors that may be applied must rest principally on judgment.

Lumber use in new residential construction in 1953 was apparently about 1 board foot per dollar of construction expenditure. It seems likely that alterations and additions may involve about that same amount of lumber use.

Residential maintenance and repair, on the other hand, involves a relatively large amount of exterior painting and interior redecorating in which little or no lumber is used. On the basis of such reasoning, it would seem that maintenance and repair might not require more than half as much lumber per dollar of expenditure as alteration and additions.

[62]The corresponding 1975 estimate by Stanford Research Institute (including a small amount of lumber for new construction by railroads) is 4,675 million board feet. The wide difference between the SRI estimate and the higher one developed in this study is due chiefly to the fact that the SRI estimate of 1975 expenditures for new nonresidential construction is extremely low. For discussion of this point, see page 34 above.

The 1975 lumber-use factors applied by SRI for new nonresidential construction other than farm imply a weighted average of 0.195 board feet per dollar of expenditure. That average is not much less than the 0.203 board feet per dollar weighted average of factors used in this study.

Use of lumber per dollar of expenditure for all maintenance, repair, alteration, and additions is estimated at 0.585 board feet per dollar of expenditure.

As the older housing with its higher lumber content per unit gradually drops out of the housing inventory and is replaced by new housing with less lumber content, there may be some decrease in the lumber-use per dollar factor. On the other hand, the do-it-yourself trend which probably results in higher standards of maintenance and more general use of lumber and other timber products would work in the opposite direction. It seems most likely that lumber-use per dollar of expenditure may be sustained fairly well. The assumed increase of real price of lumber would have some effect but probably less than in some other fields of lumber use.

These considerations support the belief that the lumber-use factor in the future may be about 0.45 board feet per dollar of expenditure. On such a basis, the demand for lumber used in maintenance, repair, alteration, and additions to residential structures might be:

Year	Billion bd. ft.
1952	3.9
1975	4.2
2000	5.9

Nonresidential Maintenance Excluding Railroad and Farm

Estimated expenditures for nonresidential maintenance and repair (not including railroad and farm) has been estimated above as follows:

Year	Billion dollars
1953	6.6
1975	11.2
2000	19.2

Information on use of lumber in this field is just as scarce as in the case of residential structures. Lacking any better evidence on lumber-use per dollar expended, it has been assumed that the factors are about the same as for new construction and that there will be the same decrease as time goes on. Those factors are as follows:

Year	Board feet per dollar
1953	0.290
1975	.203
2000	.131

On such a basis the potential demand for lumber for use in nonresidential maintenance and repair would be:

Year	Billion bd. ft.
1953	1.9
1975	2.3
2000	2.5

For Use by Railroads, Including Maintenance

About 5 percent of the lumber consumed in the United States in recent years has been utilized by the railroads. Of an estimated total volume of lumber used by the railroads in 1952 of 1.9 billion board feet, about 63 percent was in the form of crossties, switch

ties, and bridge ties, about 22 percent went into freight-car construction and repair, and the remaining 15 percent was used for the construction and maintenance of buildings, bridges, crossings, fences, and similar facilities.

Crossties

The existing information on the number of crossties laid annually, 1940-52 (by railroads that report such data to the Interstate Commerce Commission) is summarized in table 20. These Interstate Commerce Commission statistics include all ties laid by Class I railroads both in replacement and in new track mileage. For Class II, Class III, and Switching and Terminal railroads, these statistics include only crossties laid in replacement. They do not include those laid in new trackage.

The Interstate Commerce Commission figures, further, do not include crossties laid by those electric railroads that are not part of steam railroad systems, or by proprietary, circle, or unofficial railroads. The total crosstie consumption not included in the Interstate Commerce Commission statistics probably amounts to between 1.5 and 2.0 million pieces.

A rough confirmation of this last estimate is available from the reports of number of crossties treated annually by wood preserving plants (table 20). During the 13-year period 1940-52, the treating plants processed 582.5 million crossties. In the same period, those railroads reporting to ICC laid 543.3 million treated ties. The difference between reported number of ties treated and reported number of treated ties laid during the period is 39.2 million or an annual average of 3 million. There has been a small export of treated crossties, but this is partially offset by the number of untreated ties laid by railroads that do not report their tie-laying activities to Interstate Commerce Commission.

On the basis of the evidence just presented, the number of crossties laid by all railroads in 1952 is estimated at 38 million, or 1.5 million more than was reported to ICC.

The number of crossties that will be required by the railroads in the future depends on a number of factors: (1) mileage of track operated, (2) volume of traffic and maintenance standards necessary to sustain that traffic, (3) average service life of crossties, and (4) mileage of new tracks laid.

Track operated. The mileage of track operated at the end of each year by Class I, Class II, Class III railroads, and by switching and terminal companies has been estimated by the Interstate Commerce Commission as shown in table 21. Track mileage of these railroads reached a peak of 411 thousand miles in 1930. In the 10-year period 1930-40, there was a net decrease of 26 thousand miles, or an average of 2.6 thousand miles per year. In the 1940-52 period, there was a net decrease of 11 thousand miles or an annual average of 916 miles per year. In view of this record, it seems most likely that there will be some further reduction in mileage of maintained railroad track during the period 1952-75. But it would probably be a mistake to expect still further decline in railroad mileage. In spite of competition by other modes of transportation, the railroads are and will probably remain the major carrier of goods. Despite competition by other carriers, the ton-miles of rail freight continues to increase. If population of the United States increases by 100 million, and the output of goods continues to expand as expected, the railroad network will probably have to be expanded to some extent.

With these considerations in mind, the mileage of all railroad track, including electric, proprietary, circle, and unofficial railroads in 1952, 1975, and 2000 has been estimated as follows:

Year	Thousand miles of track: Total	Laid with crossties	Laid with switch and bridge ties
1952	[1] 390	363	27
1975	376	350	26
2000	400	372	28

[1] This figure includes an estimated 16,000 miles of electric, proprietary, circle, and unofficial railroads. Only a part of these roads file any report with the Interstate Commerce Commission. Those that did file reports in 1951 reported operation of 10,442 miles of road. The estimate of 16,000 miles of track takes account of the fact that miles of track of the reporting railroads would be somewhat greater than miles of road, and also of the fact that many such railroads do not report at all to the Interstate Commerce Commission.

TABLE 20.--Number of crossties laid, as reported to Interstate Commerce Commission 1940-52; number of crossties reported treated 1940-54; apparent available supply 1940-52

Year	Crossties reported laid[1]			Crossties reported treated[3]	Apparent available supply[4]
	Total	Untreated[2]	Treated		
	Million	*Million*	*Million*	*Million*	*Million*
1940	49.2	7.2	42.0	42.7	49.9
1941	53.9	6.7	47.2	47.7	54.4
1942	56.7	5.7	51.0	54.2	59.9
1943	52.4	4.8	47.6	48.2	53.0
1944	54.4	3.8	50.6	53.0	56.8
1945	49.5	3.2	46.3	46.7	49.9
1946	43.1	2.7	40.4	45.7	48.4
1947	43.3	2.5	40.8	47.9	50.4
1948	43.6	2.4	41.2	41.2	43.6
1949	35.9	1.9	34.0	40.0	41.9
1950	35.6	1.6	34.0	36.5	38.1
1951	34.8	1.7	33.1	36.8	38.5
1952	36.5	1.4	35.1	41.9	43.3
1953	([5])	([5])	([5])	39.4	([5])
1954	([5])	([5])	([5])	33.5	([5])

[1] U. S. Interstate Commerce Commission, STATISTICS OF RAILWAYS IN THE UNITED STATES. Includes all crossties laid, both in replacement and in new tracks, by the Class I railroads, but only ties laid in replacement by the Class II railroads, Class III railroads, and the switching and terminal companies.

Does not include any of the ties laid by electric, proprietary, circle, or unofficial railroads. Many of these roads do not report to the Interstate Commerce Commission. Those that do report to ICC operated 10,442 miles of track in 1951.

[2] Includes estimated number of untreated ties laid in replacement by Class II and Class III railroads and by switching and terminal companies based on ratio of untreated to treated ties laid by Class I railroads.

[3] U. S. Forest Service and American Wood Preservers Association, WOOD PRESERVATION STATISTICS.

[4] Number of ties reported treated plus number of untreated ties laid. Still does not include the untreated ties that may be laid in new track by Class II, Class III railroads, switching and terminal companies nor the untreated ties laid by electric, proprietary, circle, and unofficial railroads.

[5] Data not yet available.

TABLE 21.--Mileage of track operated by Class I, Class II, and Class III steam railroads and by switching and terminal companies, estimated mileage of track laid with crossties and with switch and bridge ties, 1927-52

Year	Miles operated[1]	Miles laid with:	
		Crossties[2]	Switch and bridge ties
	Thousand	*Thousand*	*Thousand*
1927	406	380	26
1928	409	382	27
1929	410	383	27
1930	411	384	27
1931	410	383	27
1932	408	381	27
1933	405	378	27
1934	402	375	27
1935	398	372	26
1936	395	369	26
1937	393	367	26
1938	390	364	26
1939	387	361	26
1940	385	359	26
1941	382	356	26
1942	379	353	26
1943	378	352	26
1944	377	351	26
1945	377	351	26
1946	377	351	26
1947	376	350	26
1948	376	350	26
1949	376	350	26
1950	375	349	26
1951	375	349	26
1952	374	348	26

[1]U. S. Interstate Commerce Commission, STATISTICS OF RAILWAYS IN THE UNITED STATES. Does not include the mileage of track operated by electric railroads (other than electrified mileage of steam railroad systems), proprietary, circle, and unofficial railroads.
[2]Estimate based on ratio of mileage laid with crossties to mileage laid with switch and bridge ties in Class I railroads, as reported to Interstate Commerce Commission.

While track mileage has been decreasing (and may continue to decrease for a while), the intensity of track use has been increasing quite rapidly. For the Nation's railroad system as a whole, revenue ton-miles per mile of road averaged 735 thousand in 1900. By 1925 that average was 1,614 thousand ton-miles, or more than double the 1900 average. By 1950, it had risen to 2,497 thousand ton-miles per mile of road.[63] This latter 55 percent increase in traffic density occurred despite the competition offered by motor trucks and pipelines. Unless some new form of transportation appears, rail traffic density may well increase by another 50 percent or more by 1975, and it may double by

[63] Interstate Commerce Commission, STATISTICS OF RAILROADS IN THE UNITED STATES, p. 157, 1951.

2000. This increase in traffic density has demanded heavier rolling stock, heavier rail, and larger crossties. The average volume of crossties treated in 1916 was about 32 board feet. By 1952 the average had increased to 38 board feet. It is estimated that average volume per tie will increase to 40 board feet by 1975 and to 42 board feet by 2000. In 1910 most of the railroad track in the United States was laid with ties spaced two feet from center to center or 2,640 ties per mile. By 1930 the average number of ties per mile had increased to 2,988. By 1952 it had increased to about 3,007. It is estimated that the average by 1975 will be about 3,010 and by 2000 it may be 3,020.[64]

Service Life of Ties. Average service life of crossties has been increased from a maximum of about 10 years to 30 or more years by preservative treatment. By 1951 some 94.9 percent of all ties under Class I railroads were treated material. Of all crossties laid by Class I, Class II, and Class III railroads in 1952, 96.2 percent were treated. But there are still about 70 million untreated ties under rails in the United States. Most of these will have to be replaced within the next ten years. Treatment of ties to retard decay is the solution to only a part of the problem. With the increase of traffic density and heavier rolling stock, the problem of mechanical failure grows more serious. A study of 400,000 ties made by one railroad shows the following causes of failure: plate cut 33 percent, shatter 29 percent, split 24 percent, accident 6 percent, decay 5 percent, ring separation 2 percent, breaks 1 percent.

With the increase in mechanical wear to contend with, it does not seem likely that the average service life of crossties will be extended very much beyond what it now is. On the basis of 1948-52 tie replacements in track of Class I railroads, the present average service life of ties is about 31.7 years. It has been assumed that the average in 1975 and in 2000 will be 33 years.

New Track Laid. Information on mileage of new track laid annually is available only for the Class I railroads. That mileage during the period 1940-52 has been as follows:[65]

Year	Miles laid	Year	Miles laid
1940	697	1947	1,202
1941	1,147	1948	1,433
1942	1,876	1949	1,096
1943	1,623	1950	1,090
1944	1,246	1951	1,387
1945	1,119	1952	1,538
1946	1,065		

The average mileage laid annually during this 13-year period by the Class I railroads was 1,271 miles. With the inclusion of all other railroads, the average must have been somewhere near 1,500 miles. It is assumed that the 1975 mileage of new tracks laid may be about 1,500 miles and that the average in the year 2000 may be about 2,000 miles.

Total Crosstie Requirement. On the basis of the analysis presented above the estimates of crosstie requirements in 1975 and 2000 are as follows:

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64 It is quite possible that these estimates may prove to be too conservative. At least one major railroad has installed 3,250 ties per mile in new track.

65 Interstate Commerce Commission, STATISTICS OF RAILWAYS IN THE UNITED STATES.

Item		1975	2000
Miles of track laid with crossties	thousand	350	372
Average crossties per mile	number	3,010	3,020
Number of ties in use	million	1,054	1,123
Average life of crossties	years	33	33
Replacement requirement	million	32	34
New track laid on crossties	miles	1,400	1,850
Crossties per mile	number	3,010	3,020
Crossties laid in new track	million	4	6
Total crossties requirement	do.	36	40
Sawn ties	number	33	40
Hewed ties	do.	3	--

The lumber equivalent of 33 million sawed crossties at 40 board feet per tie would amount to 1,320 million board feet. This is the estimated 1975 potential demand for sawn railroad ties. The corresponding estimate for year 2000, based on 42 board feet average volume per tie is 1,680 million board feet.

Sawed and hewn ties. Fifty years ago about three-fourths of all crossties consumed annually were the hewn variety. Since that time the hewn-tie portion of tie consumption has been shrinking quite rapidly. In reporting on crossties treated in 1952, the wood preserving companies made a breakdown between hewn ties and sawed ties for 76 percent of their output. They reported 7 million hewn ties treated. Since this reporting covered only 76 percent of all ties treated, and since there are a good many untreated hewn ties laid, it has been estimated that total hewed tie consumption in 1952 was about 10 million. The corresponding reports by the treating plants in 1953 covered 94 percent of their output and the number of hewn ties treated was down to 5.5 million. In 1954 reports covered 88 percent of output, and reported 3.0 million hewn ties treated.[66] In view of the recent almost-complete coverage in treating plant reports and the comparatively small number of untreated ties laid (both hewn and sawed), it seems likely that hewn-tie consumption in 1954 was down to 4 million ties or less. On the basis of this evidence, the hewn tie demand for 1975 has been estimated at 3 million. It has been assumed that by year 2000 hewn ties will have disappeared from the picture.

Switch and Bridge Ties

The average annual replacement of switch and bridge ties per mile of Class I railroad track laid on such ties during the period 1948-52 amounted to 4,250 board feet mile.[67] Assuming that this average replacement rate is generally applicable to the total mileage of railroad track laid on switch and bridge ties, the estimated volume of these ties laid in replacement in all railroads in 1952 is 115 million board feet. As roadbed is improved to carry heavier rail, there will probably be some increase in the average size of switch and bridge ties. It is therefore estimated that the average replacement per mile in 1975 will be 4,275 board feet and in 2000 it may be 4,300 board feet. On this basis the estimated switch and bridge tie requirements for replacement in 1975 and 2000 are estimated as follows:

		1952	1975	2000
Switch and bridge ties	miles	26,000	26,000	28,000
Annual replacement per mile	bd. ft.	4,250	4,275	4,300
Replacement requirement	million bd. ft.	115	111	120

[66] U. S. Forest Service and American Wood-Preservers Association, WOOD PRESERVATION STATISTICS.

[67] Interstate Commerce Commission, STATISTICS OF RAILWAYS IN THE UNITED STATES.

About 7 percent of the track mileage of Class I railroads is laid on switch and bridge ties. This percentage has remained about constant over the period (1927-52) for which such data are available.[68] It is probably a fair assumption that about 7 percent of the new trackage laid annually is on switch and bridge ties. On that basis, the 26 million board feet of switch and bridge ties reported laid by Class I railroads in new track in 1951 may have been placed on about 97 miles of track. This would imply an average of about 270 thousand board feet per mile of track.

Applying that same 7 percent to estimated mileage of new track that may be built in 1975 and 2000 and raising the average board feet per mile to 280 thousand and 300 thousand respectively, gives the following estimates of switch and bridge tie requirements for new track in 1975 and 2000:

	1952	1975	2000
Switch and bridge ties ------------------ miles	105	105	140
Average volume per mile ------- thous. bd. ft.	270	280	300
Volume required ------------- million bd. ft.	28	29	42

Summarizing, the estimated total switch and bridge tie requirements for 1975 and 2000 are as follows:

	1952	1975	2000
For replacement-------------- million bd. ft.	115	111	120
For new track ---------------- do.	28	29	42
Total ----------------------------------	143	140	162

Railroad Car Construction and Repair

Cars in freight service on the railroads of the United States increased to a maximum of 2.7 million in 1926. From then until 1939 there was a moderate decrease to somewhat less than 2.0 million, but since 1940 the number in service has increased again to approximately 2.1 million. In addition to cars in freight service, there are about 100,000 company-service cars in use. The total number of cars in service in 1952 was approximately 2.2 million.[69]

Number of cars, however, is not the whole story because average capacity per car has been increasing. That average in 1926 was about 45 tons and in 1952 about 53 tons.[70] This is an increase of about 18 percent. Just how much increase there has been in average size of car and in quantity of material going into its construction is not known, but apparently there has been some increase in both.

The distribution of cars in freight service as of 1950 and the average lumber content of new cars constructed in 1948 by types were as follows:

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[68] Same as footnote 67. Data on volume of switch and bridge ties laid in new trackage in 1952 were not yet published at time of writing.

[69] Includes small allowance for cars owned by electric, proprietary, circle, and unofficial railroads.

[70] Interstate Commerce Commission, STATISTICS OF RAILWAYS IN THE UNITED STATES.

Type	Distribution (percent)	Lumber per car[1] (bd. ft.)
Refrigerator	6.3	5,500
Stock	2.4	3,300
Box	35.5	2,800
Flat	3.3	1,800
Gondola and hopper	43.4	[2]1,400
Tank	7.3	([3])
Coal and other	1.8	([3])
Total	100.0	

[1] Data from American Railway Car Institute.
[2] Wood floor gondola only. Others contain almost no lumber.
[3] Negligible.

Because those types of freight car (with the exception of boxcars) that contain a considerable amount of lumber constitute a minority of the freight-car rolling stock, the average lumber content per car for all cars built in 1952 is estimated at 1,260 board feet. The total volume used is estimated at 100 million board feet. The trend toward all-steel boxcars and extensive use of plywood in boxcars and refrigerator cars will most likely continue. It is assumed that average lumber content per car will be down to 1,000 board feet by 1975 and to 900 by 2000.

Looking ahead to 1975 with the expected substantial increase in rail traffic, it seems probable that the number of new freight cars that would be built in that year will not be any less than the 1948-52 average which was about 85,000 cars. By 2000 the annual production of freight cars may be about 100,000 per year. On such a basis the lumber demand for new car construction would be 85 million board feet in 1975 and 90 million in 2000.

With regard to lumber consumed in maintenance and repair of freight cars, only fragmentary information is available. Surveys of wood used in manufacture have produced estimates of total lumber used in construction and repair of freight cars. Subtracting the estimated volume used for new cars, indicates the following quantities used for car maintenance and repair in specified years:

Year	Million bd. ft.
1928	859
1933	326
1940	445
1948	372

On the basis of reported expenditures by the railroad for maintenance of rolling stock, the estimated consumption of lumber for car maintenance in 1952 is 330 million board feet.

With the gradual retirement of cars containing a high lumber content, it seems probable that the volume of lumber used for this purpose will decline to 300 million board feet by 1975 and to 275 million board feet by 2000.

Summarizing the estimated potential demand for lumber that may be used in railroad car construction and maintenance is as follows:

		1952	1975	2000
For new cars	million bd. ft.	100	85	90
For car maintenance	do.	330	300	275
Total		430	385	365

Buildings and Structures

Substantial volumes of lumber are also used by railroads for construction and repair of many kinds of buildings and structures, such as bridges, trestles, crossings, fences, snowsheds, signs, wharves, docks, etc. Some of this construction is done by private contractors and is included in estimates for nonresidential construction, but railroads use considerable lumber for "force account" repair and construction. In 1944, for example, the "requirements" of Class I railroads indicated in a survey conducted by the Office of Defense Transportation totaled 1,018 million board feet, with about 50 percent of the total needed for buildings and structures and the balance mainly for car construction. Actual purchases of lumber by Class I railroads in 1944 totaled 802 million board feet, indicating use of about 400 million board feet for buildings and structures. On this basis all railroads are estimated to have used 422 million feet in 1944.

Estimates based on railway expenditures for maintenance, as reported to the Interstate Commerce Commission indicated that 1944 was a peak year in lumber consumption for buildings and structures. Consumption was estimated at 325 million board feet in 1930, about 200 million board feet in 1938, and about 275 million board feet in 1952.

In spite of considerable fluctuations in the volume of lumber used for buildings and structures, the trend in consumption has been downward and is expected to decrease further. Concrete and steel, brick, plywood, and other materials are being used increasingly where lumber use in construction was once common. For many uses where lumber is used, life is extended by use of preservatives. As older buildings or other structures are replaced, lumber requirements for maintenance are also expected to decline. There is little basis for estimating future use of lumber, but consumption and substitution trends suggest an estimated level of about 200 million board feet annually by 1975 for construction and repair of buildings and structures, and about the same for the year 2000.

Summary of Estimates

The estimate of 1952 consumption and 1975 and 2000 potential lumber demand by railroads are summarized as follows:

	1952 (million bd. ft.)	1975 (million bd. ft.)	2000 (million bd. ft.)
Crossties (sawed)	1,064	1,320	1,680
Switch and bridge ties	143	140	162
Lumber for cars	430	385	365
Lumber for structures	275	200	200
Total lumber	1,912	2,045	2,407
Hewn ties as lumber equivalent	380	114	--
Grand total	2,292	2,159	2,407

Rounding these lumber estimates to the nearest million board feet, the estimates are: 1952 consumption 1.9 billion board feet, 1975 estimated demand 2.0 billion, 2000 estimated demand 2.4 billion board feet.

Farm Service Buildings Including Maintenance and Repair

Potential demand for lumber in construction of new farm dwellings and in maintenance and repair of farm housing has been included above in the estimates covering all residential construction and maintenance. This section deals only with farm service buildings such as barns, sheds, fences, and other nonresidential facilities. The estimates include maintenance and repair as well as new construction.

No census of farm service buildings has ever been taken. The nearest approach to anything of the kind was the sampling survey of farm buildings conducted by the Forest Service in the 1930's.[71] As a result of that study, it was estimated that the barns and other service buildings standing on farms at that time contained about 116 billion board feet of lumber.

The Department of Agriculture, on the basis of various studies that have been made, estimates depreciation of farm service buildings on the basis of 40 years of useful life. That implies an average annual replacement rate of 2.5 percent per year. At such a rate the normal replacement of buildings, as estimated in the 1930's, would have required about 2.9 billion board feet of lumber per year. This, of course, makes no allowance for replacement of fire and other disaster losses, for establishment of new farms on land that previously had no buildings upon it, nor for enlargement of the buildings on existing farms. The total consumption of lumber on farms for nonresidential use must have been somewhere near 3.5 billion board feet. Counterbalancing these considerations, however, is the fact that materials other than lumber are being used in the construction of farm service buildings, that the number of farms has decreased and that the substitution of tractors and trucks for horsepower has reduced the need for large barns on a great many farms. It is quite probable that the net result has been to reduce the annual demand for lumber for farm service buildings and other nonresidential facilities to the neighborhood of 3.0 billion board feet. This amount would provide an average of 600 board feet per farm per year for the 5 million farms existing in 1950. While many farms do not use this much new lumber per year for nonresidential purposes, it is also true that there are many that use a great deal more.

Trends toward greater use of materials other than lumber on farms may be offset in part by the need for more shelter for livestock, more storage capacity, better shelter for machinery and other equipment, and a general improvement of farm buildings. On those assumptions, the potential demand for lumber for use in farm service building construction, maintenance and repair in 1975 is estimated at 2.5 billion board feet and in 2000 at the same amount.

For Use in Mining Including Maintenance

Lumber is consumed in mining operations in the form of sawed timbers, sawed mine-track ties, dimension, and boards. Such lumber is used for construction of breakers and other buildings, chutes, shafts and tunnel timbering, and various other structures. It is used also as cap boards, header blocks, wedging material in placement of round mine timbers, as track ties, and for a number of other purposes. About two thirds of the total lumber used is by coal mines; the remainder is used by metal mines.

Four surveys conducted by the Forest Service show the following consumption of lumber by the mining industry:

Year	Million board feet
1905	436
1923	507
1935	467
1950	840

In view of the upward trend of these estimates the 1952 consumption of lumber by the mining industry is estimated at 900 million board feet.

Future demand for lumber in mining will be affected to a considerable extent by the large increase of minerals output expected by 1975 and 2000. On the other hand, it will also be affected by greater mechanization of mining operations. Strip mining operations

[71] Hallauer, Frank J. LUMBER REQUIREMENTS ON THE FARM, U. S. Forest Service, Washington, D. C. 1942.

consume almost no lumber. Substitution of conveyor belts in underground mines eliminate the need for mine railways. These are only two of the technological changes that tend to reduce lumber consumption per unit of mine output.

Consideration of factors that will tend to increase and to decrease demand for lumber in mining operations appear to justify an estimate of 1975 demand at about 1 billion board feet and of 2000 demand at 1.5 billion board feet. This implies a 1950-75 increase of 19 percent and a 1975-2000 increase of 50 percent. The increase in output of minerals will of course be very much larger than these percentages.

Manufactured Products

A large number of industries use lumber in the fabrication of manufactured products.[72] In recent years, those using the largest amounts include the manufacturers of: furniture and fixtures, caskets and burial boxes, truck bodies, woodenware and novelties, handles, radios and phonographs, patterns and flasks. Each of these classes of manufacturing consumed over 100 million board feet of lumber in 1948. A total of 3.9 billion board feet, in that year, went into making of the products listed in table 22.

The quantity of lumber consumed in the manufacture of the products listed has varied considerably from year to year--depending partly on the fluctuations of business activity. Volume consumed in 1933, for example, was only 40 percent of that used in 1948. Estimates of the amount used during specified years since 1912, and of the relationship of volume used for this purpose to total lumber consumption are shown in table 23. Those estimates indicate that for several decades about 10 percent of total lumber consumption has been in fabrication of the products listed in table 22.

The quantity of lumber going into output of furniture and fixtures, patterns and flasks, boot and shoe findings, and sports equipment has apparently been increasing to some extent. With respect to many other products, there has been a marked decrease in quantity of lumber consumed.

Lumber for Furniture

The furniture industry consumes about half of the lumber used in making those products presently under consideration. Potential demand for lumber in this field of use will be influenced to a large extent by the future demand for furniture.

Lumber and wood in other forms are still favored materials for household furniture. But there are definite indications that metal in combination with textiles, plastics, foam rubber, and other nonwood materials are gaining in popularity. Whether the popularity of furniture made of such materials will increase or be permanent is difficult to judge. What does seem clear is that lumber is already facing stiffer competition in the household-furniture materials field than it has experienced in the past. Its competitive position will be weakened still further if the real price of lumber continues to increase as it has during the past decade.[73]

With respect to office and professional furniture, the shift from wood to metal is already almost complete. Wood office furniture is now confined quite largely to what might be described as the luxury grade of office furniture. It seems rather unlikely that the producers of lumber will be able to recapture very much of the office-furniture material market.

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[72] In addition to the 3.9 billion board feet used during 1948 in fabrication of the products listed in table 22, some 8.3 billion board feet went into other products that could be classed as manufactures. These included millwork, flooring, prefabricated structures, boxes, and railroad cars. Potential demand for lumber in production of these products has been included above in the estimates covering construction, railroads, and shipping uses.

[73] The real price of household furniture, over the past decade, has increased very little if at all. See Bureau of Labor Statistics, INDEX OF WHOLESALE PRICES.

TABLE 22.--Lumber used in fabrication of specified manufactured products, 1928, 1933, 1940, 1948

Product	1928	1933	1940	1948
	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*
Furniture	1,283	692	1,260	1,948
Fixtures	124	34	74	172
Caskets and burial boxes	156	125	154	155
Vehicles (chiefly truck bodies)	898	202	131	147
Woodenware and novelties	102	39	92	133
Handles	34	45	160	127
Radios, phonographs, sewing machines	[1] 10	26	63	122
Patterns and flasks	29	33	91	105
Ship and boat building	124	35	86	93
Agricultural implements	135	17	41	68
Pencils and penholders	38	14	29	66
Boot and shoe findings	25	21	54	57
Sports equipment	27	8	36	55
Toys	37	21	54	54
Musical instruments	101	8	27	53
Ladders	([2])	9	30	50
Signs, scenery, displays	65	9	17	45
Refrigerators[3]	142	49	34	38
Venetian blinds	---	---	50	37
Electrical equipment	40	9	19	37
Matches	115	74	74	35
Plumbers' woodwork	16	5	8	33
Laundry appliances	28	12	32	29
House trailers	([2])	([2])	([2])	29
Trunks and valises	15	4	9	28
Machinery	39	1	9	27
All other	160	66	165	149
Total[4]	3,744	1,557	2,803	3,894

[1] Radios and phonographs included in "all other" in 1928.
[2] Included in "all other."
[3] Includes kitchen cabinets.
[4] Items may not add to totals on account of rounding.

Source: U. S. Forest Service, WOOD USED IN MANUFACTURES.

TABLE 23.--Estimates of lumber used in manufacture[1] during specified years, 1912-50

Year	Quantity used		Year	Quantity used	
	Total	As proportion of all lumber consumed		Total	As proportion of all lumber consumed
	Billion bd. ft.	*Percent*		*Billion bd. ft.*	*Percent*
1912	5.3	12.3	1941	3.3	9.2
1920	4.0	11.9	1942	3.8	8.8
1925	4.5	11.4	1943	4.3	11.0
1928[2]	3.7	10.6	1944	4.2	12.0
1930	3.2	10.5	1945	3.7	12.0
1933[2]	1.6	8.6	1946	3.7	11.0
1935	2.1	8.2	1947	3.8	11.4
1936	2.3	9.0	1948[2]	3.9	10.7
1937	2.5	9.7	1949	3.4	10.4
1938	1.9	8.2	1950	3.8	9.6
1939	2.3	8.1			
1940[2]	2.8	8.2			

[1] Covers these products listed in table 22.
[2] These estimates are from Forest Service surveys of lumber used in manufactures. Estimates for other years interpolated on basis of reported number of production workers in these types of manufacturing.

Estimates of the future requirements for household furniture can be made in a number of ways. One obvious factor that will increase the consumption of such furniture will be the increase in number of households. Estimates of the number of households that may exist at specified future dates have been developed in an earlier section of this chapter. Those estimates and the percentage increases over number of households in 1950 are as follows:

Year	Households (thousand)	Increase over 1950 (percent)
1950	42,826	--
1954	46,893	9.5
1960	50,100	17.0
1965	53,900	25.9
1970	58,900	37.5
1975	65,000	51.8
2000	91,000	112.5

This approach suggests that the bare minimum increase of household furniture demand for the period 1950-75 will be about 52 percent and for the period 1950-2000 about 112 percent. Such increases, however, would only take care of the net increase of households and maintain present volume of replacement. Several studies of consumer expenditures show that increases of family income below the $10,000 per year bracket usually result in a somewhat higher percent being spent for furniture and house furnishings.[74] The

[74] See for example, "Survey of Consumer Finances 1953," FEDERAL RESERVE BULLETIN, July 1953.

increasing real income (both per capita and per family) anticipated in the future will probably result in more rapid replacement of furniture by families of the middle and lower income brackets.

Traditionally, the manufacturers of household furniture have paid close attention to residential construction activity as an indicator of short-term prospective demand for new furniture. There is, undoubtedly, a tendency for families moving into new housing to purchase more than their usual amount of new furniture. Otherwise, it is probably not so much a matter of cause and effect that accounts for this parallelism, as the result of a situation in which consumers have disposable income to spend for durable goods and are in a mood to use it for that purpose.

Estimates of annual expenditures for new furniture 1929-53 in relation to disposable personal income are shown in table 24. These indicate that such expenditures over the period as a whole have averaged 1.3 percent of disposable personal income. The two

TABLE 24.--Consumer expenditures for household furniture in relation to disposable personal income, 1929-53

Year	Disp. pers. income[1]	Exp. for household furn.[2]		Year	Disp. pers. income[1]	Exp. for household furn.[2]	
		Total	As proportion of income			Total	As proportion of income
	Million dollars	*Million dollars*	*Percent*		*Million dollars*	*Million dollars*	*Percent*
1929	83,120	1,167	1.40	1945	150,355	1,541	1.02
1930	74,374	905	1.22	1946	159,182	2,179	1.37
1931	63,840	767	1.20	1947	169,016	2,500	1.48
1932	48,660	486	1.00	1948	187,601	2,715	1.45
1933	45,744	442	.97	1949	188,157	[3] 2,820	1.50
1934	51,980	495	.95	1950	206,130	[3] 3,341	1.62
1935	58,322	648	1.11	1951	226,069	[3] 3,345	1.48
1936	66,222	830	1.25	1952	236,734	[4] 3,229	1.36
				1953	250,371	[4] 3,294	1.32
1937	71,000	904	1.27	1954	254,814	[4] 3,265	1.28
1938	65,692	809	1.23				
1939	70,444	931	1.32	1929-54 average			1.30
1940	76,076	1,044	1.37				
1941	92,962	1,295	1.39		Projections		
1942	117,516	1,260	1.07				
1943	133,547	1,222	.92	1975	[5] 433,000	[6] 6,062	1.40
1944	146,761	1,295	.88				
				2000	[5] 826,000	[6] 10,738	1.30

[1] U. S. Department of Commerce, NATIONAL INCOME 1954 EDITION, pp. 164-5; SURVEY OF CURRENT BUSINESS, p. 11. July 1955.
[2] Forman, James B., THE FURNITURE INDUSTRY AND ITS POTENTIAL MARKET, p. 14. U. S. Department of Commerce. 1950.
[3] Estimates made by Dewhurst, Frederick J. and Associates. AMERICA'S NEEDS AND RESOURCES, p. 970. Twentieth Century Fund, New York. 1955. Adjusted to exclude purchase of second-hand furniture.
[4] U. S. Department of Commerce. SURVEY OF CURRENT BUSINESS, p. 19. July 1953.
[5] Based on the 1953 ratio of disposable personal income to gross national product. Dollars in terms of 1953 prices.
[6] In terms of 1953 prices.

periods in which expenditures were well below that average were 1932-35 and 1942-45. The obvious reason for restriction of expenditures in the first period was diminished personal income during the depression years. In the latter period, production of furniture and other durable civilian goods was curbed in order to have maximum output of military material. The above-average expenditure in 1947-51 undoubtedly involved purchases that had to be deferred in the war years.

On the whole, it is to expect that expenditures for new furniture in 1975 (when new household formation will be comparatively high) would not be less than 1.4 percent of disposable personal income. By the year 2000 (if birthrates have subsided to the lower levels assumed in the population projection used in this study) new household formation will, comparatively, be at a lower rate than in 1975. Expenditures for new household furniture might be about 1.3 percent of disposable personal income. On the basis of these assumptions the expenditures (at 1953 prices) are estimated at $6.0 billion by 1975 and $10.7 billion by 2000 (table 24). The increase in quantity of furniture demanded during the period 1952-75 would be 88 percent and during the period 1952-2000, it would be 233 percent.[75]

The Bureau of the Census has published estimates of the quantity of lumber used in manufacture of household furniture in 1953 and 1954.[76] That study shows that 1,605 million board feet were so used in 1952 and 1,582 million in 1953.

These lumber consumption estimates apply to the quantities used in manufacture of furniture while the dollar figures presented above are for consumer expenditures for furniture. Because of changes in the quantity of furniture in the distribution channels, any lumber-use per dollar of expenditure factor based upon such estimates can be indicative only. The 1952-3 average was 0.488 board feet per dollar of consumer expenditure.

Despite the long-continued rise in the real price of lumber, it is still the preferred material for household furniture. Further increase of real price would be expected to have less effect upon demand in this market than in many others. It has therefore been assumed that the drop in lumber used per dollar of expenditure will be from the 1952-3 average of 0.49 board feet to 0.45 by 1975 and to 0.40 by 2000. This would be a drop of 8.2 percent during the period 1952-75 and of 18.4 percent during the period 1952-2000.

On the basis of the foregoing evidence, the potential demand for lumber in manufacture of household furniture is estimated as follows:

	1952-53 average	1975	2000
Expenditure----------million dollars	3,262	6,062	10,738
Lumber used--------- million bd. ft.	1,593	2,728	4,295
Lumber per dollar----------- bd. ft.	0.49	0.45	0.40

[75] Stanford Research Institute has projected a 95 percent increase in "output of furniture and fixtures" for the period 1952-75. AMERICA'S DEMAND FOR WOOD, 1929 - 1975, page 48.

The dollar figures in the Institute's report are in terms of 1952 price and they apparently apply to factory shipments rather than to consumer purchases. The Institute's figures on output are not comparable with the consumer-expenditure figures shown in table 24, page

[76] Bureau of the Census, FACTS FOR INDUSTRY, HOUSEHOLD FURNITURE AND BEDDING PRODUCTS, 1953, Series M54A-03, November 1954, page 15.

Part of the difference between Forest Service estimates of lumber used in furniture manufacture in 1948 and the Census Bureau's estimates for 1952-53 can be accounted for in the difference in coverage. The Forest Service estimates include office and professional furniture but the Census Bureau estimates do not. The Census Bureau estimates also exclude wood frames purchased by furniture manufacturers.

Adding to these estimates an allowance for the lumber that would be used in manufacture of office, professional, school, and church furniture; the total potential demand for furniture lumber would probably be as follows:

Year	Million bd. ft.
1952	2,000
1975	3,300
2000	4,900

Lumber for Other Products

The manufacture of products (other than furniture) listed in table 22 absorbed 1,944 million board feet of lumber in 1948.

Estimating future demand for these products, and for the lumber required in making them, presents some difficulties because the number of items is rather large. The procedure adopted has been to group the products into several categories.

Boot and shoe findings are part of the equipment used in manufacture of shoes. Consumption of shoes can be expected to increase somewhat faster than the increase of population. Consumption of caskets and burial boxes can be expected to increase less rapidly than the increase of population.[77] The consumption of matches will probably follow the population trend quite closely; and the same may be true for pencils and penholders. Consumption of trunks and other luggage items will probably increase somewhat faster than population, because rising per capita disposable income enables people to do more traveling.

Demand for refrigerators, kitchen cabinets and sewing machines will probably increase at a rate equal to the increase in number of households. The same may be true for venetian blinds, laundry appliances, and plumbers' woodwork.

A third group of products come under the heading of luxury or semiluxury items. Consumption of such products is likely to coincide rather closely with disposable personal income--particularly if per capita income continues to rise as expected. The products included in this category include sports equipment, toys, radios,[78] musical instruments, house trailers, woodenware and novelties. It is probable that the consumption of fixtures, and of signs, scenery and displays, will also coincide rather closely with disposable personal income. All are used in the selling of merchandise; the volume of trade will be determined chiefly by disposable personal income.

Demand for agricultural implements will probably be associated with the trend of total farm output.

The remaining assortment of products includes ladders, vehicles, handles, ships and small boats, electrical equipment, machinery, patterns and flasks, and a miscellaneous collection of other products. None of these fit very well in the categories mentioned above. Future demand for each of these has been projected on the basis of judgment.

Population, number of households, disposable personal income, and total farm output as of 1948 and 1952 with projections to 1975 and to 2000 are shown in table 25. Total farm output has been projected on the basis of the expected increase of food consumption. The other projections were discussed in the earlier section dealing with underlying assumptions.

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[77] As long as population is increasing, the increase in the number of deaths will necessarily be less than the increase of population.

[78] Includes record players and television sets.

TABLE 25.--Factors most likely to influence demand for certain manufactured products[1] 1948 and 1952; projections to 1975 and 2000

Item		1948	1952	Projections	
				1975	2000
Population	(Million persons	[2] 147	[2] 157	210	275
	(Percent	100	107	143	187
Households	(Million	[3] 41	[4] 46	65	91
	(Percent	100	112	159	222
Disposable personal income	(Billion 1953 dollars	[5] 209	[5] 239	433	826
	(Percent	100	114	207	395
Total farm output	(Billion 1953 dollars	[6] 33	[6] 34	[7] 50	[7] 68
	(Percent	100	103	152	206

[1] Those products listed in table 22, excluding furniture.
[2] U. S. Department of Commerce. STATISTICAL ABSTRACT, p. 13. 1954.
[3] STATISTICAL ABSTRACT, p. 51. 1953.
[4] STATISTICAL ABSTRACT, p. 53. 1954.
[5] U. S. Council of Economic Advisors. ECONOMIC REPORT OF THE PRESIDENT, pp. 148-149. 1955. Converted from 1954 dollars by use of implicit price deflator; 1953 = 0.996 of 1954.
[6] U. S. Department of Commerce. SURVEY OF CURRENT BUSINESS, p. 23. August 1954. Converted from 1947-49 dollars by use of implicit price deflator; 1953 = 0.975 of 1947-49.
[7] Based on projected increase of demand for food: 48 percent in 1950-75 period and 100 percent in 1950-2000 period. Total farm output in 1950 (at 1953 prices) was $33.9 billion.

These anticipated percentage increases in demand for each class of product (table 26) has been used as the basis for estimating the potential demand for lumber that might be used in its manufacture by 1975 and by 2000.

The procedure involved a basic projection of the quantity of lumber used in making each product in 1948, assuming no decrease in quantity of lumber used per unit of product output. That projection was then adjusted downward to provide the estimate of lumber demand assuming a substantial increase in the real price and continuation of substitution trends. Information for years prior to 1948 (table 22, page 74) provided some guidance in making the adjustments; but, for the most part, they are a matter of judgment. The results of these operations are shown in table 27.

The estimated 1952 consumption of lumber in the manufacture of the products under consideration, and the estimated demand for 1975 and 2000 are as follows:

Year	Million bd. ft.
1948 consumption ---------	1,944
1952 consumption ---------	2,155
1975 demand -------------	2,755
2000 demand -------------	4,120

The estimates of potential demand, according to this method of analysis, would imply a 19 percent average decrease in lumber use per unit of product in the period 1948-75 and a 28 percent decrease in the period 1948-2000 (table 27).

TABLE 26.--Percentage increase in population, number of households, disposable personal income, and total farm output 1948-52, with projections to 1975 and 2000, estimated percentage increase in consumption of specified products 1948-52 with projections to 1975 and 2000

Item	1948	1952	Projections	
			1975	2000
Population	100	107	143	187
Boot and shoe findings	100	108	147	195
Caskets and burial boxes	100	104	130	170
Matches	100	107	143	187
Pencils and penholders	100	107	143	187
Trunks and other luggage	100	110	157	200
Households	100	112	159	222
Refrigerators[1]	100	115	165	240
Venetian blinds	100	115	165	240
Laundry appliances	100	113	162	230
Plumbers' woodwork	100	112	159	222
Disposable personal income	100	114	207	395
Sports equipment	100	115	210	400
Toys	100	115	210	400
Radios and televisions	100	115	210	400
Musical instruments	100	110	200	350
Woodenware, novelties	100	114	207	395
House trailers	100	108	175	320
Fixtures	100	114	207	395
Signs and displays	100	114	207	395
Total farm output	100	103	152	206
Agricultural implements	100	103	152	206
Ladders	100	110	150	200
Vehicles[2]	100	115	210	400
Handles	100	110	150	200
Ships and small boats	100	105	140	170
Electrical equipment	100	110	175	375
Machinery	100	110	175	375
Patterns and flasks	100	110	175	375
All other	100	110	150	200

[1] Kitchen cabinets and sewing machines are also included under this item.
[2] Lumber is used chiefly in truck bodies and truck trailers.

TABLE 27.--Estimated consumption of lumber in manufacture of specified products, 1948 and 1952; projected demand without and with a decrease in lumber use per unit of product, 1975 and 2000

Item	Consumption		Projected demand		Projected demand	
			Without decrease		With decrease	
	1948	1952	1975	2000	1975	2000
	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*
Boot and shoe findings	57	62	84	111	80	100
Caskets and burial boxes	155	161	202	264	175	200
Matches	35	37	50	65	20	5
Pencils and penholders	66	71	94	123	80	90
Trunks and other luggage	28	31	44	56	35	40
Total	341	362	474	619	390	435
Percent decrease					18	30
Refrigerators[1]	38	44	63	91	45	50
Venetian blinds	37	43	61	89	45	50
Laundry appliances	29	33	47	67	30	30
Plumbers' woodwork	33	37	52	73	40	50
Total	137	157	223	320	160	180
Percent decrease					28	44
Sports equipment	55	63	116	220	100	180
Toys	54	62	113	216	75	150
Radios, televisions	122	140	256	488	225	400
Musical instruments	53	58	106	186	100	170
Woodenware, novelties	133	152	275	525	270	500
House trailers	29	31	51	93	35	45
Fixtures	172	196	356	679	250	450
Signs, displays	45	51	93	178	75	100
Total	663	753	1,366	2,585	1,130	1,995
Percent decrease					17	23
Agricultural implements	68	70	103	140	90	110
Percent decrease					13	21
Ladders	50	55	75	100	65	80
Vehicles[2]	147	169	309	588	200	300
Handles	127	140	191	254	185	230
Ships, small boats	93	98	130	158	110	125
Electrical equipment	37	41	65	139	50	60
Machinery	27	30	47	101	30	45
Patterns, flasks	105	116	184	394	175	375
All other	149	164	224	298	170	185
Total	735	813	1,225	2,032	985	1,400
Percent decrease					20	31
Total	1,944	2,155	3,391	5,696	2,755	4,120
Percent decrease					19	28

[1] Kitchen cabinets and sewing machines also included under this item.
[2] Chiefly truck bodies and truck trailers.

Summary of Estimates of Lumber for Use in Manufacture

The estimated total volume of lumber consumed in the manufacture of furniture and other products in 1948 and 1952, and the estimated potential demand for such lumber, are as follow:

Year	Billion bd. ft.
1948 consumption----------	3.9
1952 consumption----------	4.2
1975 demand --------------	6.0
2000 demand --------------	9.0

While this market for lumber is not large in comparison with the construction-industry market, it is far more stable. Competing materials are continually encroaching, but with respect to many of these products, lumber is still in a very strong position.

For Use in Shipping

Between 15 and 20 percent of the lumber consumed in the United States during the past thirty years has been used in connection with the shipment of other commodities (table 28). During the years of World War II, the volume used for shipping purposes varied between 9.5 billion board feet in 1942 and 14.5 billion in 1944. The bulk of this huge demand was for overseas shipment of military supplies. During the depression years, on the other hand, demand for shipping lumber was below 4.0 billion board feet.

Lumber used in shipping can be classified by four end-uses: (1) wooden boxes, cases, andcrates--nailed and wirebound,[79] (2) dunnage for holding cargo in place in ship holds and freight cars, (3) reels and spools for cable and wire, grain doors for freight cars, and a number of other minor items, and (4) pallets used for the mechanical handling of packaged commodities by fork-lift trucks or by other devices. The discussion to follow will treat each of these classes separately.

Wooden Boxes, Cases, and Crates--Nailed and Wirebound

Department of Commerce estimates of volume of lumber used in manufacture of nailed boxes, cases, and crates and of the lumber component of wirebound boxes 1940-54 are shown in table 29. Output of the nailed containers was very high during World War II, but since then it has declined to about the level of 1940. The output of wirebound boxes has been increasing quite steadily. The 1954 production of this type of container was 72 percent above that of 1940. But the volume of lumber used in wirebound boxes is comparatively small in relation to that used in the nailed containers.

Since the 1920's the nailed container has been steadily displaced by the fiber box. More recently the wirebound box and crate has been gaining favor. The principal reasons for the shift are that the fiber and wirebound container is generally cheaper; it is also lighter--adding less weight to the goods that are shipped in it. Fiber packing cases come from the factory in convenient bundles that can readily be stored in small space and set up without special equipment. They are well adapted to the modern trend toward pre-packaged goods, and they are entirely adequate for shipments by truck in which only a limited quantity of cases are piled one on top of the other. These advantages are too important to permit the nailed wooden box to recover the markets that have been lost to competing containers.

There are several fields of use in which the nailed wooden box or crate is not likely to be displaced. These are in the shipment of heavy pieces of machinery of odd shape (aircraft engines are an example) that cannot well be fitted into any standard-size con-

[79] The wirebound box or crate is made partly of lumber and partly of veneer.

TABLE 28.--Estimated volume of lumber used in shipping, 1920-52

Year	Volume used[1] Total	Volume used[1] As proportion of all lumber consumed	Year	Volume used[1] Total	Volume used[1] As proportion of all lumber consumed
	Billion bd. ft.	*Percent*		*Billion bd. ft.*	*Percent*
1920	6.1	18	1938	3.4	14
1921	4.7	17	1939	4.0	14
1922	5.1	15	1940	4.3	13
1923	5.3	13	1941	5.4	15
1924	4.7	12	1942	9.5	22
1925	5.0	12	1943	14.2	37
1926	5.2	13	1944	14.5	42
1927	5.3	15	1945	12.0	39
1928	5.9	16	1946	7.4	22
1929	6.3	19	1947	5.8	17
1930	5.0	17	1948	6.0	17
1931	4.0	19	1949	5.8	17
1932	2.8	16	1950	6.4	16
1933	2.9	16	1951	7.1	18
1934	3.1	18	1952	6.9	17
1935	3.7	16			
1936	4.1	16			
1937	4.4	17			

[1] Forest Service estimate.

TABLE 29.--Estimated volume of lumber used in manufacture of nailed boxes and crates, and of wirebound boxes, 1940-54

Year	Total		Nailed boxes and crates		Wirebound boxes	
	Million bd. ft.	Index	Million bd. ft.	Index	Million bd. ft.	Index
1940	4,515	100	4,295	100	220	100
1941	5,732	127	5,500	128	232	105
1942	9,122	202	8,840	206	282	128
1943	12,080	268	11,838	276	242	110
1944	11,762	261	11,500	268	262	119
1945	10,765	238	10,500	244	265	120
1946	5,859	130	5,600	130	259	118
1947	5,300	117	5,040	117	260	118
1948	5,247	116	5,000	116	247	112
1949	4,747	105	4,475	104	272	124
1950	5,289	117	4,975	116	314	143
1951	5,341	118	4,990	116	351	160
1952	4,989	110	4,641	108	348	158
1953	4,901	109	4,530	105	371	169
1954	4,038	89	3,660	85	378	172

Source: Estimate for 1940-48, U. S. Department of Commerce. CONTAINERS AND PACKAGING. December 1948. Estimates for subsequent years based on year-to-year percentage change of output as reported in CONTAINERS AND PACKAGING.

tainer. Much of this type of goods requires more protection than can be obtained from a fiber or wirebound container. Fragile goods like plate glass also require the additional protection afforded by the nailed wooden container. Goods of all kinds packaged for export still require the nailed wooden box. The wooden box, both nailed and wirebound, has been preferred for shipment of fresh fruits and vegetables in refrigerator cars because it is resistent to moisture. However, fiber containers of high wet strength have begun to be used for shipment of certain fruits and vegetables. That wooden containers can continue to hold their dominant position in this field is subject to serious question.

The price disadvantage of the nailed wooden container is obviously due in part to the price spread that has developed between lumber and fiber boxboard since 1947 (fig. 5). Further development of that price disparity will certainly tend to reduce the demand for wooden containers in those fields where fiber containers are an acceptable substitute.

Considering the potent competition that confronts nailed wooden containers, and assuming a further substantial increase in the price of lumber relative to that of fiber boxboard, it appears that demand for nailed containers is more likely to decrease than to increase by 1975. By 1975, the nailed wooden containers may be strictly confined to those uses in which substitute containers are not practicable. Some increase in demand during the 1975-2000 period would appear to be probable to take care of the increased output of those commodities for which wooden containers are most suitable. Judgments such as these, of course, do not lend themselves to statistical methods of projection. The following estimates of future demand for box lumber are contingent upon later estimates of increased demand for fiber boxboard and for veneer. Whether the shift to these other container materials will actually be as drastic as here assumed is by no means certain. Increased demand for container material will, no doubt, develop, but recent trends appear to be in favor of fiber boxboard and veneer rather than sawed lumber. The following estimates of future demand for boxboard are intended to reflect that trend.

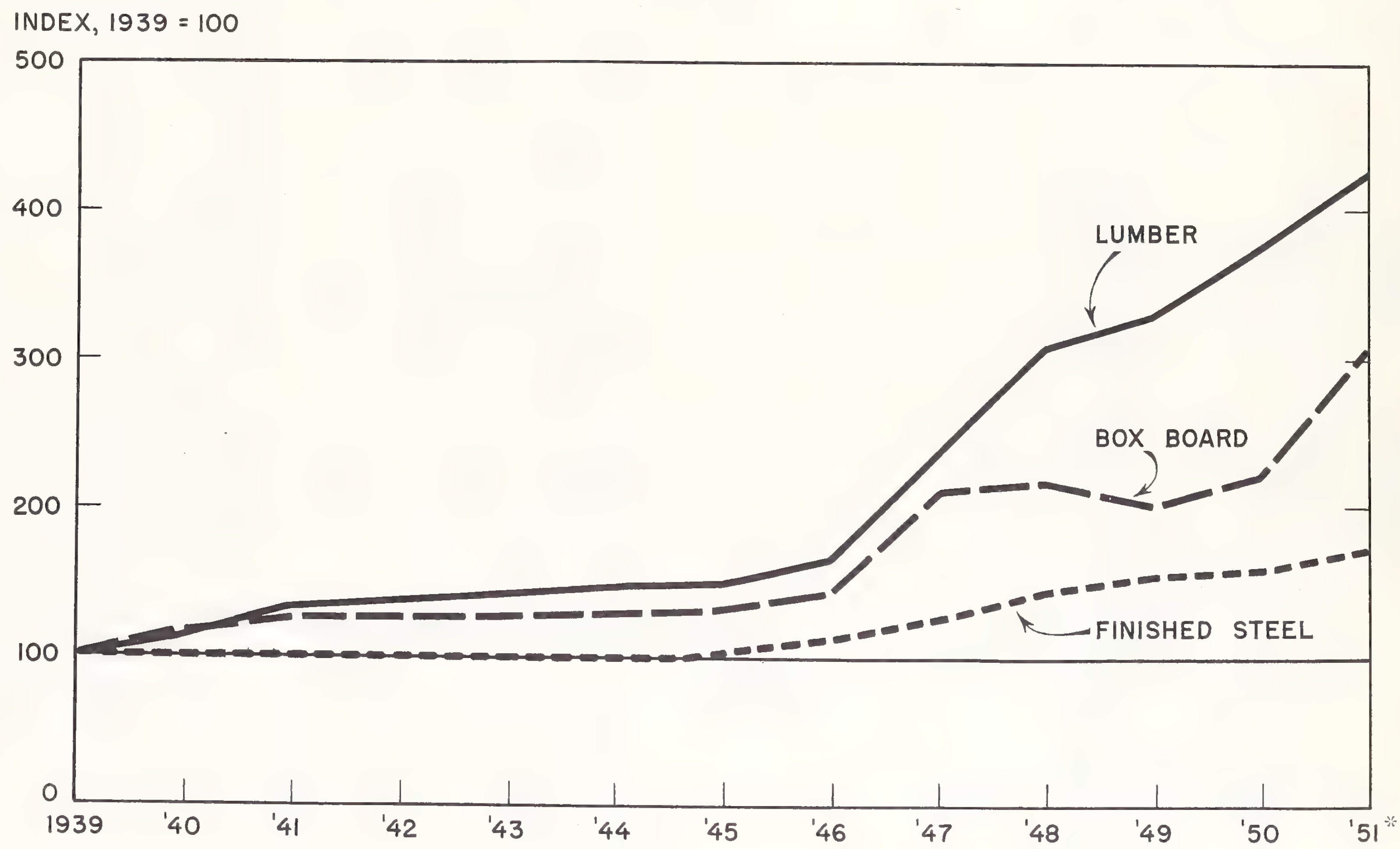
	Box and crate lumber for:		
	Nailed containers	Wirebound containers	Both types of containers
	(million bd. ft.)	(million bd. ft.)	(million bd. ft.)
1952 Consumption	4,641	348	4,989
1975 Demand	3,500	500	4,000
2000 Demand	4,500	1,000	5,500

Lumber for Pallets

The use of pallets for mechanical handling of packaged goods in factories, warehouses, and in shipping has been increasing very rapidly. Further increase in such use can be expected.

While metal and fiberboard have been used in the making of pallets, lumber appears to have a firm position as the principal pallet material. The standard pallet is 48 inches square, and contains an average of about 25 board feet.

The National Wooden Pallet Manufacturers Association has made the following estimates of production of wooden pallets during the years 1950-54, and of the volume of lumber used in their fabrication:



* ESTIMATED
FROM - U. S. DEPARTMENT OF COMMERCE, NATIONAL PRODUCTION AUTHORITY, CONTAINERS AND PACKAGING DIVISION

Fig. 5 - Average price trends of selected basic raw materials used by container manufacturers

Year	Number of pallets	Volume of lumber
	(million)	(million bd. ft.)
1950------------------	23	575
1951------------------	27	675
1952------------------	33	825
1953------------------	40	1,000
1954------------------	36	900

Pallets have been used extensively for not more than ten to fifteen years. Little is known about what their average service life will be--estimates vary from 10 to 15 years. So far, the lumber used in making pallets has not been treated material. For those exposed to the weather, treated lumber may come into use. That would tend to prolong their service life and to reduce the quantity of lumber required.

Another difficult problem is to judge the size of the potential market for pallets. The indications are that it is still far from saturated.

The following estimates of future demand for pallet lumber are frankly a matter of judgment.

	Million bd. ft.
1952 Consumption---------	825
1975 Demand-------------	1,400
2000 Demand-------------	1,900

Lumber for Dunnage

Information on the total volume of lumber used for dunnage has never been collected. The 1948 survey by the Forest Service of lumber used by manufacturing establishments shows that these firms used 612 million board feet of dunnage lumber during that year.[80] This, of course, does not include all the dunnage lumber that actually was used. The total amount consumed in this use was probably around 1 billion board feet.

Modern methods of loading freight cars, the trend toward handling commodities in packages rather than in bulk, and the increase of truck transportation have all tended to reduce the use of dunnage. Assuming that the price of lumber goes still higher in the future, further effort to reduce dunnage can be expected. On the basis of these considerations, demand for dunnage lumber in 1975 and 2000 is estimated at 1 billion board feet, or approximately the same as the estimated consumption in 1948.

Lumber for Other Shipping Uses

About 79 million board feet of lumber were used in 1948 in the manufacture of grain doors for railroad cars.[81] Other quantities were used for cable reels, wire spools, and some other items. Data on the exact volumes consumed in all these minor items are not available, but it appears unlikely that the total exceeded 100 million board feet.

It is very probable that plywood and other fiberboard will displace lumber as grain-door material. Metal is also being used for cable reels and for wire spools. In view of such competition, it is likely that demand for lumber for use in these products will be no greater in 1975 and 2000 than it was in 1948.

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[80] WOOD USED IN MANUFACTURE 1948, page 63.
[81] WOOD USED IN MANUFACTURE 1948, page 27.

Summary of Estimated Demand for Shipping Lumber

The various estimates of 1952 consumption of lumber used in shipping and the estimated 1975 and 2000 potential demand are summarized as follows:

	1952 Consumption	1975 Demand	2000 Demand
	(million bd. ft.)	(million bd. ft.)	(million bd. ft.)
Nailed boxes and crates	4,641	3,500	4,500
Wirebound boxes and crates	348	500	1,000
All boxes and crates	4,989	4,000	5,500
Pallets	825	1,400	1,900
Dunnage	1,000	1,000	1,000
Other items	100	100	100
All shipping lumber	6,914	6,500	8,500

Summary of Estimated Potential Demand for Lumber, Lower Level Basis

The various estimates, by major end-uses, of 1952 consumption of lumber (fig. 6), and of 1975 and 2000 potential demand have been brought together in table 30.

These estimates of demand (assuming a further substantial increase in the real price of lumber relative to the real price of competing materials, and continuation of substitution trends) add up to 48 billion board feet by 1975 and to 57.0 billion by 2000. These figures are for the total quantity of lumber that may be demanded. It is well known that the use of lumber salvaged from demolition of buildings and from other sources has been increasing in recent years. Under the impact of higher prices for new lumber, re-use would be expected to increase much faster. Stanford Research Institute has estimated that 500 million board feet of lumber were re-used in 1952.[82] No attempt has been made to adjust the 1952 consumption estimates of this study for re-use, but the 1975 and 2000 estimates of demand have included 2.0 billion board feet of re-use. The estimated demand for new lumber, on the basis of these assumptions, is 46 billion board feet in 1975 and 55 billion in 2000 (table 30).

Softwood-Hardwood Distribution

Many of the existing statistics on end-use consumption of lumber give no indication of distribution between softwood and hardwood. The more reliable data on that distribution are the estimates of lumber consumption as a whole.[83] The lumber consumption estimate for 1952 indicates that 33.4 billion board feet were of softwood species and 8.1 billion were of hardwood species.

In general, the softwoods are preferred for all construction uses with the exception of railroad ties, residential flooring, and some other items. Hardwood lumber is preferred for many of the manufactured products and for pallets. There are many fields of use in which either softwood or hardwood lumber can be utilized. The softwood-hardwood distribution of estimated demand for lumber has been made with the expectation that past

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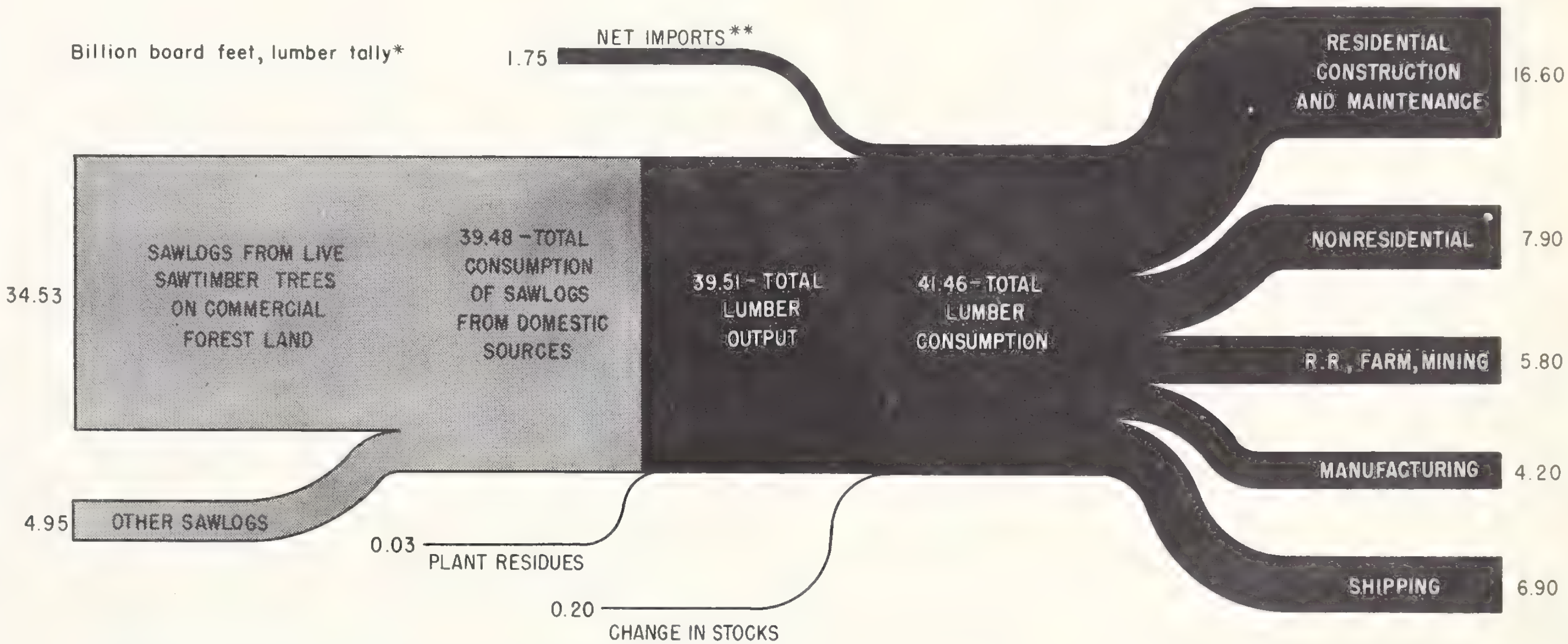
[82] AMERICA'S DEMAND FOR WOOD. 1929 - 1975, page 50.

[83] Estimates of the total volume of lumber consumed have been made on the basis of the reported annual production, plus the net imports, with adjustment for changes in the stocks of lumber on hand at mills. The production and the export-import figures do contain a softwood-hardwood breakdown.



* For discussion of the cubic volume of timber cut in connection with the production of lumber and other products, see Chapter III.

** Including small quantity of sawlog imports.

Fig. 6 - Source of lumber consumed in the United States in 1952 and end uses.

TABLE 30.--Estimated 1952 consumption of lumber by major end-use; estimated potential demand, 1975 and 2000

End-use	Estimated consumption, 1952[1]	Potential demand[2]	
		1975	2000
	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*
New residential construction	12,700	16,500	16,800
Residential maintenance and repair[3]	3,900	4,200	5,900
Total residential	16,600	20,700	22,700
New nonresidential construction[4]	6,000	7,000	8,000
Nonresidential maintenance and repair[4]	1,900	2,300	2,500
Total nonresidential	7,900	9,300	10,500
Railroad construction and maintenance	1,900	2,000	2,400
Farm service buildings[5]	3,000	2,500	2,500
Lumber used in mining	900	1,000	1,500
Total lumber used in construction	30,300	35,500	39,600
Lumber used in manufactured products	4,200	6,000	9,000
Lumber used in shipping	6,900	6,500	8,500
Total lumber used	(7)	48,000	57,100
Re-use of lumber	(7)	2,000	2,000
New lumber consumption or demand	[6] 41,462	46,000	[6] 55,000

[1] New lumber only.
[2] Includes re-used lumber.
[3] Includes additions and alterations to residential buildings.
[4] Not including railroad and farm.
[5] Includes new buildings, and maintenance and repair.
[6] Items do not quite equal this total because of rounding.
[7] Not estimated.

preferences will continue, but that the price increase for softwood lumber may be somewhat greater than for hardwood due to the proportionally larger increase in the demand for construction lumber. On the basis of these assumptions, the distribution of the estimated 1975 and 2000 demand is as follows:

	Softwood (million bd. ft.)	Hardwood (million bd. ft.)	Total (million bd. ft.)
1952 Consumption---	33,408	8,054	41,462
1975 Demand -------	36,000	10,000	46,000
2000 Demand -------	41,000	14,000	55,000

ESTIMATES OF POTENTIAL DEMAND FOR PULPWOOD*

The largest expansion, by far, in the commercial use of timber has been for the manufacture of paper, paperboard, derived products of woodpulp (rayon, cellophane, etc.), and wood-fiber products such as hardboard and roofing felt. Measured in terms of the volume of wood used in their manufacture, consumption of these products in the United States increased from 8.1 million cords in 1920 to 37.8 million cords in 1953 (table 31). In other words, use of wood in this field has more than quadrupled within the time span of 33 years.

Per capita consumption of paper, paperboard, building board, and of all paper and boards at 5 year intervals, 1920-53, has increased as follows:[84]

Per Capita Consumption (pounds)

Year	Paper	Paperboard	Building board	All paper, and board
1920-----	102	43	--	145
1925-----	124	56	1	181
1930-----	137	62	2	201
1935-----	129	71	1	201
1940-----	161	91	2	254
1945-----	155	114	13	282
1950-----	221	146	16	383
1953-----	220	154	17	391

Consumption of paper, on a per capita basis, has more than doubled; for paperboard it has almost quadrupled. Per capita consumption of all paper and boards in 1953 was 2.7 times what it was in 1920.

Not all of the increase of pulpwood consumption is accounted for in paper and board. Beginning in 1910 with the manufacture of rayon fiber, woodpulp has been used as the basic raw material for an ever-growing list of products--cellophane, photographic film, certain plastics, smokeless powder, certain lacquers, sausage casings, and a number of other derived products. In 1952, an estimated 0.9 million tons of wood pulp (equivalent to about 2 million cords of pulpwood) was used for production of these products. Consumption in terms of wood pulp used in their manufacture amounted to about 11.5 pounds per capita.

Although the average dollar-and-cents (nominal) price of wood pulp, paper, and paperboard increased about 63 percent over the period 1920-24 to 1950-54, that increase is very largely accounted for in the decline of the general commodity-purchasing power of the dollar. The average real price of these products rose by less than 5 percent.[85] The estimates of potential demand for pulpwood, developed later in this section, are based on the assumption that any further increase in real price, prior to 2000, will be of about the same magnitude as occurred over the period 1920-24 to 1950-54.

In analyzing the past consumption trends for indications of what the future demand for pulpwood is likely to be, it is desirable to begin with consideration of consumption trends and potential demand for the various end-products of pulpwood, such as paper, paperboard, and the non-paper products of wood pulp. After that analysis is made, consideration turns to the amounts of new wood pulp required for the production of the end-

*This section was prepared in collaboration with Dwight Hair.

[84] United States Pulp Producers Association, WOOD PULP STATISTICS, 1954 edition, New York, N. Y., pages 126-129. Compiled from U. S. Department of Commerce data.

[85] For a discussion of trends in real price of these products, see Chapter V, pages 16-19.

TABLE 31.--Apparent annual consumption of domestic pulpwood, and of imported pulpwood, woodpulp, paper, and paperboard, in terms of pulpwood volume 1920-53

[Thousand cords of pulpwood]

Year	Pulpwood logs and bolts				The pulpwood equivalents of net imports of wood pulp, paper and paper board[1]									Total apparent pulpwood consumption
	Production	Imports	Exports	Total[2] apparent consumption	Wood pulp					Paper and board			Total	
					Sulphite	Sulphate	Soda	Groundwood	Other	Newsprint	Other paper	Paper board		
1920	4,873	1,100	—	5,973	970	356	—	235	—	869	-270	-34	2,126	8,099
1921	3,475	817	—	4,292	672	317	—	193	—	986	-90	-14	2,064	6,356
1922	4,524	1,050	20	5,574	1,423	587	-6	218	-3	1,274	-20	—	3,473	9,047
1923	4,533	1,236	8	5,769	1,603	497	6	303	-3	1,642	28	8	4,084	9,853
1924	4,505	1,048	17	5,553	1,868	609	-4	248	-7	1,702	6	4	4,426	9,979
1925	4,619	1,088	8	5,707	1,937	644	-6	334	-10	1,810	-33	8	4,684	10,391
1926	5,395	1,277	13	6,672	2,073	700	-4	307	-9	2,327	-48	-6	5,340	12,012
1927	5,213	1,224	59	6,437	2,068	701	-4	248	-3	2,508	-50	-13	5,455	11,892
1928	5,642	1,366	28	7,008	2,126	789	-6	251	-6	2,725	-82	-29	5,768	12,776
1929	6,347	1,233	53	7,580	2,288	796	-4	276	-8	3,053	-106	-42	6,253	13,833
1930	5,744	1,096	130	6,840	2,196	751	--	302	-11	2,883	-87	-42	5,992	12,832
1931	5,782	738	81	6,520	1,872	746	4	213	-2	2,612	-54	-39	5,352	11,872
1932	5,013	742	28	5,755	1,786	666	2	190	-1	2,266	-32	-23	4,854	10,609
1933	5,870	618	11	6,488	2,239	995	6	212	-1	2,264	-32	-24	5,658	12,146
1934	5,838	817	12	6,655	1,917	954	13	191	-2	2,777	-72	-26	5,752	12,407
1935	6,620	1,037	21	7,628	1,960	1,088	15	192	-3	2,871	87	-28	6,182	13,810
1936	7,527	1,210	21	8,716	2,278	1,314	17	230	-1	3,476	-39	-25	7,250	15,966
1937	8,895	1,523	24	10,394	2,294	1,307	4	220	-2	4,191	-87	-35	7,892	18,286
1938	7,953	1,294	53	9,194	1,845	922	13	161	-13	2,882	-52	-50	5,708	14,902
1939	9,735	1,131	50	10,816	2,097	1,123	10	230	-8	3,303	-134	-50	6,571	17,387
1940	12,369	1,436	62	13,743	894	233	2	173	4	3,453	-312	-164	4,283	18,026
1941	14,176	2,281	73	16,579	1,152	84	29	200	8	3,698	-232	-68	4,871	21,450
1942	14,907	2,232	74	17,275	1,289	-32	32	222	13	3,654	-128	-66	4,984	22,259
1943	13,580	1,712	36	15,645	1,480	27	32	238	16	3,302	-272	-13	4,810	20,455
1944	15,349	1,650	20	16,758	1,281	61	10	179	12	3,113	-250	-14	4,392	21,150
1945	15,253	1,729	41	16,913	2,027	687	21	225	11	3,330	-356	-62	5,883	22,796
1946	16,982	1,996	54	17,818	2,071	842	42	252	13	4,397	-276	-32	7,309	25,127
1947	18,542	2,077	79	19,714	2,380	1,226	42	312	12	4,989	-302	-55	8,604	28,318
1948	20,026	2,307	39	21,189	2,353	1,080	50	294	12	5,544	-184	-41	9,108	30,297
1949	17,619	1,647	8	19,945	1,624	1,073	57	211	8	5,836	-260	-30	8,519	28,464
1950	20,712	1,834	27	23,627	2,235	1,561	71	284	7	6,120	-220	-26	10,032	33,659
1951	25,128	2,650	13	26,522	2,087	1,387	67	321	13	6,213	-357	-95	9,636	36,158
1952[3]	25,045	2,310	17	26,476	1,656	1,139	59	244	7	6,259	-360	-61	8,943	35,405
1953[3]	26,339	1,548	11	28,150	1,743	1,496	73	266	5	6,296	-198	-48	9,633	37,783

[1] Converting factors used were as follows: Sulphite pulp - 1 ton = 2.05 cords; Sulphate pulp - 1 ton = 1.78 cords; Soda pulp - 1 ton = 2.10 cords; Groundwood pulp - 1 ton = 1.01 cords; Other pulp - 1 ton = 1.02 cords; Newsprint - 1 ton = 1.27 cords; Other paper - 1 ton = 1.50 cords; Paper board - 1 ton = .69 cords

[2] Includes changes in stocks for all years 1941 through 1953.

[3] Preliminary.

Source: 1920-38 and 1940-41, American Paper and Pulp Association, STATISTICS OF PAPER, 1954 edition, New York, N.Y. (compiled from Bureau of the Census data); 1939 and 1941-53, Bureau of the Census, U. S. Department of Commerce.

products. The final step is to estimate the volume of pulpwood required to meet prospective requirements for new wood pulp.

The reasons for this involved procedure are made more apparent in figure 7. This is a flow chart showing the rather complex relationship of pulpwood consumption by domestic mills to total consumption of all the fibrous materials used in paper and paperboard production in 1952. In order to maintain comparable values across the chart, intake of pulpwood by domestic mills is expressed in terms of wood pulp equivalent. The chart also indicates the relative importance (quantity-wise) of net imports of pulpwood, of wood pulp, and of finished paper and paperboard; and of wood pulp used in the manufacture of nonpaper products. The right-hand side of the chart indicates approximate United States consumption of paper and paperboard by major grade classifications.

Consumption Trends and Potential Demand for Paper

The apparent annual United States consumption of paper by major classification, 1920-53, is shown in table 32. The increase has been from about 5.4 million tons in 1920 to about 17.6 million in 1953--an increase of 227 percent, in a time span of 33 years, or an average annual rate of 3.6 percent compounded. The corresponding periodic and average annual percentage increases by grade classes are as follows:

	Percent increase of consumption 1920-53	
	For the period	Average annual
Newsprint paper	177	3.1
Groundwood papers other than newsprint	360	4.7
Book, fine, and absorbent paper	164	3.0
Coarse and industrial paper	258	3.9
Tissue and sanitary paper	661	6.3
Building paper	250	3.9
All paper	227	3.6

Because of the marked differences in the rates at which consumption of the various classes of paper has been increasing, estimates of total future demand for paper are likely to be more reliable than estimates for any particular class.

Estimates of Potential Demand for Paper

Paper is certainly one of the most universally used materials in our modern economy. It is not surprizing that the trends in consumption of paper bear a close relationship to trends in out-put of all goods and services, or gross national product.[86] That relationship during the period 1920-53 is plotted graphically[87] in figure 8.

[86] Several analysts who have made estimates of long-term potential demand for paper have used disposable personal income (either by itself or in combination with population) as the independent factor in their projection equation. While there can be no valid objection to the use of disposable personal income data for this purpose, the advantages of doing so are probably no more important than the disadvantages.

The difficulty lies in deciding how much disposable personal income to expect at target date. This involves either some quite simple assumptions or finding answers to a group of very difficult questions. The assumptions usually are that the relationship of personal disposable income to gross national product will remain about as it was in some particular year; or that the relationship will change in favor of, or against, personal-income recipients. If change in the relationship is assumed, there must be some judgment

(Footnotes continued to page 96)

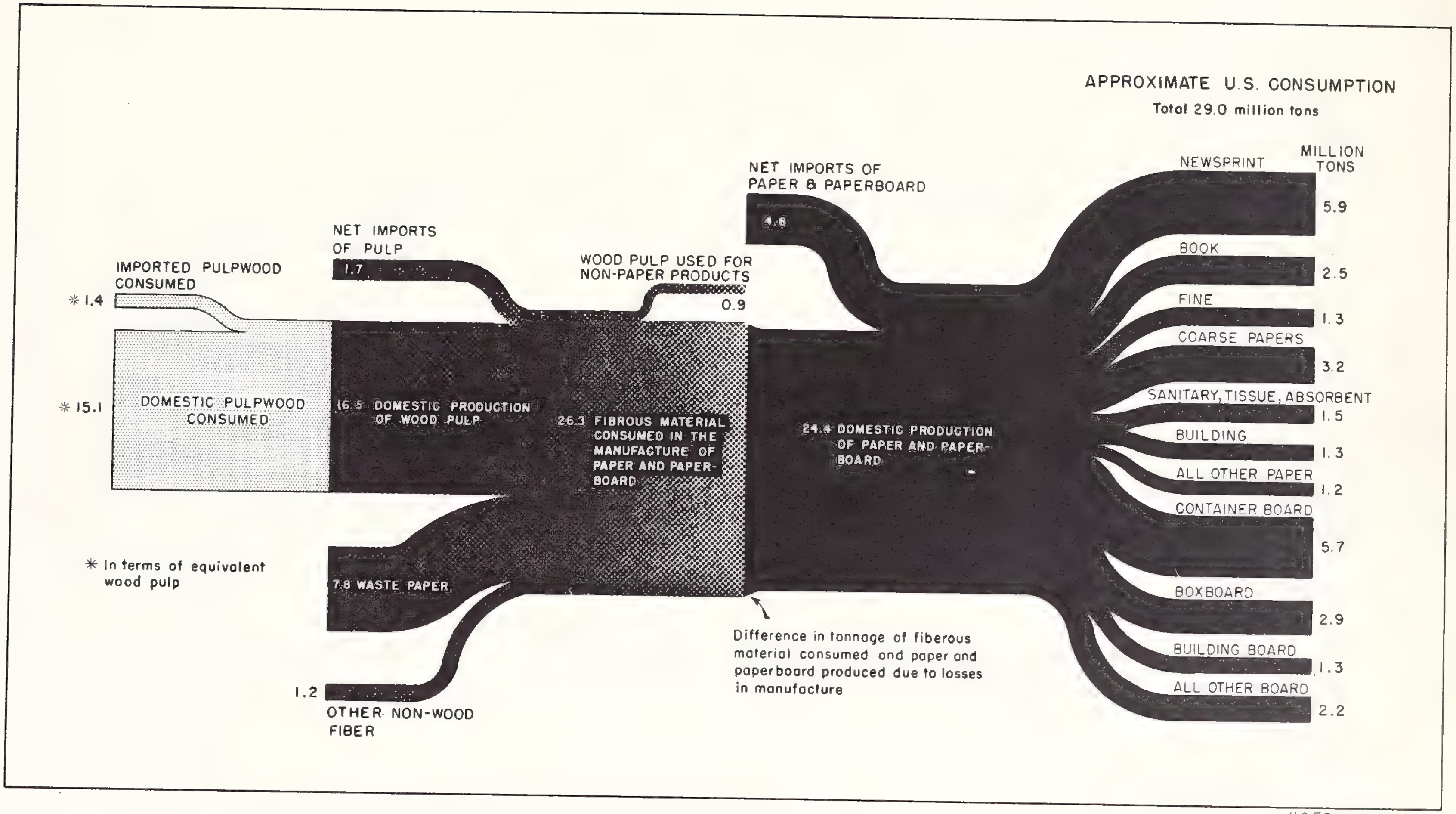


Figure 7 - Source of pulp, paper and paperboard consumed in the United States, 1952

TABLE 32.—Apparent annual consumption of paper, by principal grade classifications, 1920-53

[Thousand tons]

Year	Newsprint[1]	Groundwood[2]	Book, fine, and absorbent[3]	Coarse and industrial[3]	Tissue and sanitary[3]	Building paper	Total[4]
1920	2,196	170	1,576	1,044	195	[2] 375	5,376
1921	2,013	92	1,034	827	186	[2] 217	4,309
1922	2,451	150	1,436	1,048	215	419	5,709
1923	2,814	166	1,611	1,184	251	344	6,389
1924	2,821	170	1,602	1,235	242	348	6,424
1925	2,988	189	1,808	1,292	281	577	7,118
1926	3,516	209	1,871	1,420	310	645	7,943
1927	3,492	296	1,949	1,525	316	620	8,171
1928	3,561	235	2,309	1,467	348	560	8,432
1929	3,813	363	2,264	1,606	388	649	9,108
1930	3,496	221	2,250	1,581	362	460	8,401
1931	3,260	311	1,828	1,401	395	388	7,625
1932	2,831	125	1,626	1,244	359	290	6,518
1933	2,711	285	1,726	1,440	407	305	6,943
1934	3,177	154	1,888	1,356	397	325	7,312
1935	3,309	274	2,015	1,632	473	437	8,175
1936	3,675	199	2,460	1,879	495	546	9,309
1937	4,276	518	2,328	2,011	535	602	10,350
1938	3,101	436	2,017	1,820	543	564	8,575
1939	3,546	540	2,431	2,176	642	653	10,005
1940	3,775	550	2,534	2,352	721	677	10,616
1941	3,956	643	3,022	2,705	899	909	12,132
1942	3,749	610	2,803	2,605	974	995	11,907
1943	3,523	586	2,644	2,364	957	871	10,852
1944	3,200	593	2,432	2,462	955	876	10,512
1945	3,424	636	2,503	2,533	971	868	10,847
1946	4,200	776	3,111	2,841	1,038	1,028	13,078
1947	4,683	821	3,409	3,057	1,081	1,281	14,448
1948	5,160	772	3,581	3,229	1,183	1,314	15,376
1949	5,523	674	3,338	2,911	1,186	1,143	14,788
1950	5,856	705	3,877	3,545	1,358	1,419	16,752
1951	5,903	791	4,167	3,875	1,466	1,378	17,692
1952	5,943	806	3,950	3,480	1,352	1,293	16,914
1953	6,086	782	4,164	3,742	1,484	1,312	17,553

[1] Adjusted for changes in stocks in 1939 and 1942-53, inclusive.
[2] Domestic production.
[3] For years prior to 1937, domestic production.
[4] Data in certain lines do not add across on account of rounding, and on account of lack of export-import information for certain grades.

Source: 1920-38 and 1940-41, American Paper and Pulp Association, STATISTICS OF PAPER, 1954 edition, compiled from reports of Bureau of the Census, U. S. Department of Commerce; 1939 and 1942-53, Bureau of the Census, U. S. Department of Commerce.

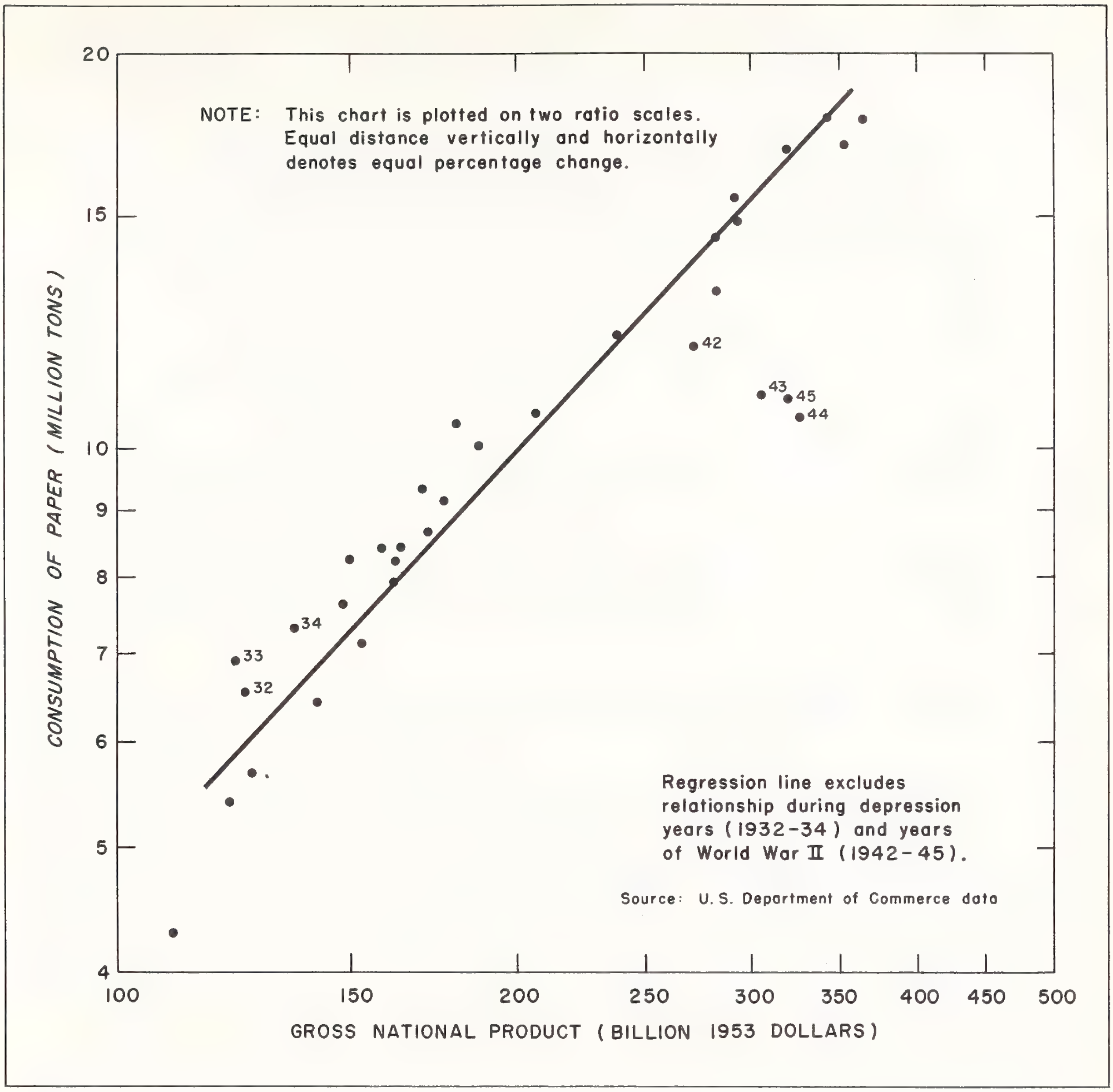


Fig. 8 — Relationship of paper consumption to gross national product, 1920-53.

The two periods in which consumption of paper and gross national product departed radically from what appears to be their normal relationship were the depression years 1932-34, and the years of World War II 1942-45. With the exception of those two episodes, the relationship has been remarkably close.

During the depression years, paper consumption decreased to a lesser extent than gross national product. In the war years, paper consumption did not keep pace with gross national product, but that was not due to lack of demand for paper. The urgent necessity for increasing production capacity in other lines made it impossible to increase output of paper at the same time. After the war was over and paper mill capacity could be increased, consumption of paper and gross national product resumed their former long-term relationship.

Earlier in this chapter (pages 10-14), future gross national product was estimated at $630 billion by 1975 and $1,200 billion by the year-2000. Both estimates are in terms of 1953 prices.

Assuming that gross national product and demand for paper would be in the same relation to each other as indicated by the regression shown in figure 8, and that gross national product increases as estimated; the 1975 demand for paper would be 34 million tons, and the year-2000 demand would be 55 million. These figures are obtained by extension of the straight-line regression shown in figure 8. Judging from the dot-pattern in figure 8, however, there appears to have been a slight tendency in the post-war years for paper consumption to increase at a slower rate. On the basis of that evidence, the 1975 estimate of demand for paper has been lowered to 31 million tons and the year-2000 estimate has been lowered to 50 million.

Allocation of 1975 Demand Estimate by Grade Classifications

Within the framework of estimated 1975 demand for all paper, allocations have been made to the six major classifications of paper grades. Such allocations must, of course, be based to a larger extent upon judgment. Over-estimation of demand for one classification and under-estimation of demand for another, in some instances, would have little effect upon subsequent estimates of requirements for new wood pulp and pulpwood. In other instances involving those classification grades of paper which normally contain a considerable fraction of fibrous material other than new wood pulp or a large fraction of high-yield pulps (such as groundwood or semi-chemical) over-estimation would affect wood pulp and pulpwood estimated to a considerable extent.

Newsprint paper: Consumption of newsprint paper in the United States increased from about 2.2 million tons in 1920 to 6.1 million in 1953, an increase of about 177

Footnotes continued from page 96.
as to how future gross national product will be distributed, and that involves answers to these questions: (1) How much of projected future gross national product will be absorbed by capital consumption and corporate savings? (2) How much will be taken by government through indirect business taxes, corporate taxes, personal taxes, and social insurance contributions? (3) How much will be returned by government to individuals through interest payments and transfer payments? None of these three questions can be answered with much confidence. But without some positive answers, there is less certainty about the level of disposable personal income at target date than there is about the level of gross national product.

In view of the difficulties that estimation of future disposable personal income involves (if not made on the basis of simple assumptions), most of the projections in this study have been based on gross national product rather than on disposable personal income.

[87] This type of chart, using ratio (logarithmic) scales on both the vertical and horizontal axes, is a convenient device for indicating the relationship of percentage change in one variable (gross national product) to percentage change in the other variable (consumption of paper).

percent in 33 years (table 32 above). From 1920 to 1929 consumption rose quite steadily. After 1929, there was a sharp decrease that lasted until 1933. This was followed by an upswing which carried consumption back up to a little above the 1929 peak by 1937. The year 1938 brought another sharp decline followed by an upward trend till 1941, and then came another slump resulting from wartime shortages. Since 1944, newsprint consumption has nearly doubled, rising from 3.2 million tons to 6.1 million in 1953. With the exception of the wartime period, the rise and fall of newsprint consumption has been associated with fluctuations in general business activity.

Based on the 1920-53 relationship of gross national product and population to newsprint consumption, the indicated potential demand by 1975 would be 10.2 million tons, an increase of 67 percent over 1953 consumption.

There is, however, some doubt that newsprint consumption will continue to grow at quite that rate. Other advertising media are offering strong competition, and daily newspapers may be approaching the limit of practicable size.

In 1920 there was one daily newspaper per 3.8 inhabitants of the United States. In 1950 this ratio had changed to one paper per 2.8 inhabitants. What the saturation point may be is not known, but it would appear to be somewhere not far from one newspaper per two inhabitants.

These considerations appear to justify a lowering of the 1975 newsprint demand estimate arrived at statistically from 10.2 million tons to 9.3 million. This latter estimate would provide an increase in per capita consumption from 76 pounds in 1953 to 89 pounds in 1975.

Groundwood papers other than newsprint: Papers (other than newsprint) manufactured from groundwood pulp are used for a long list of items, such as telephone directories, catalogues, wallpaper, mimeograph and business machine paper, scratch pads, and many others.

Consumption of this grade of paper increased from 170 thousand tons in 1920 to 782 thousand in 1953, an increase of 360 percent (table 32 above).

Consumption of these papers doubled in the 1920's. The depression brought on a slump from 363 thousand tons in 1929 to 125 thousand in 1932. In the recovery period, consumption rose again to 540 thousand tons by 1939 and went on up to 643 by 1941. The materials shortages during World War II are not so evident in the consumption trend for this grade of paper. The high point of the entire period 1920-53 came in 1947 at 821 thousand tons.

Based on the 1920-53 relationship of gross national product and population to consumption of these papers, the indicated demand by 1975 would be 1.8 million tons, an increase of 130 percent. This projection, however, may be on the high side. During the period 1947-53 with economic activity at a high level, there has been no increase in consumption of these papers. The estimate of 1975 potential demand has therefore been lowered to 1.5 million tons. That quantity is approximately double the consumption of 1953.

Book, fine, and absorbent papers: Consumption of book, fine, and absorbent papers increased from 1.6 million tons in 1920 to 4.2 million in 1953, an increase of 164 percent (table 32).

After a severe drop in 1921, consumption increased quite rapidly until 1928. There was a slight decline in 1929 and 1930, followed by a steep decline lasting through 1932. This was followed by an upward trend which carried consumption back to a level slightly above the previous 1928 peak in 1936. Then came another 2-year decline, followed by rapidly increasing consumption up to the 3.0 million tons level in 1941. World War II

brought on some rather drastic curtailment, but the upward trend was resumed again in 1945 and continued with only minor interruption until 1953.

While there are some differences, the trend in consumption of this grade of paper has been roughly parallel to that of gross national product. Since book, fine, and absorbent papers are largely a consumer good, the equation used for estimating 1975 potential demand is based on the relationship of gross national product and population to consumption of these papers. The estimate derived by this method is 7.4 million tons. No evidence pointing to the need for modification has been observed.

Coarse and industrial papers: A large part of the coarse paper consumed in the United States is used for packaging and wrapping purposes. Industrial papers are used for items such as punch cards, electrical insulation material, file folders, and many others.

Consumption of this grade of paper increased from 1.0 million tons in 1920 to 3.7 million in 1953, an increase of 258 percent. The 1920-53 trend in consumption of coarse and industrial papers resembles that of gross national product except that consumption of these papers has increased more rapidly than gross national product. There was, of course, a moderate decline of paper consumption during the years of World War II, while gross national product continued to increase, but that was a temporary condition.

Looking ahead to 1975, it is reasonable to expect that the demand for coarse and industrial paper will increase at about the same rate as gross national product. This would indicate an increase of about 100 percent over 1953 consumption to about 7 million tons.

Tissue and sanitary papers: Consumption of tissue and sanitary papers increased from 0.2 million tons in 1920 to 1.5 million in 1953, an increase of 661 percent (table 32 above).

Consumption of this class of paper has been increasing rapidly and steadily with only minor and temporary setbacks in the depression years. During World War II, the upward trend was arrested but there was comparatively little decrease. From 1946 through 1953, consumption increased again but at a somewhat slower rate than previously.

Estimation of potential 1975 demand for tissue and sanitary papers presents a problem because consumption during the past thirty-five years has increased so much faster than population, personal income, gross national product, or any other factors commonly used in projections of demand.

Per capita consumption of this class of paper in 1953 was 18.7 pounds. If disposable personal income should increase in direct proportion to gross national product (as projected in this study), per capita disposable personal income would rise about 30 percent by 1975. If per capita demand for tissue and sanitary papers increased by 30 percent, it would rise to 24.3 pounds by 1975. On that basis, a 1975 population of 210 million would be expected to buy about 2.6 million tons of this class of paper. Making allowance for some further displacement of textiles (handkerchiefs, surgical gauze, and the like) in this field, the estimate of 1975 demand for tissue and sanitary papers is placed at 3.0 million tons, an increase of approximately 100 percent over 1950 consumption.

Building paper: The various building papers include sheathing paper, roofing felts, felts for asphalt tile, automotive felts, asbestos-filled paper, and a number of other items. Roofing felts accounted for about 76 percent of all building paper production in 1952.

Apparent United States consumption[88] of building papers increased from 375 thousand tons in 1920 to about 1.3 million tons in 1953, an increase of 250 percent (table 32 above).

During the 1920's consumption of building paper almost doubled. This increase was followed by a rapid decline from 1929 to 1932. During the period of recovery, and up to 1950, consumption increased quite rapidly with a few minor setbacks. There was a moderate decline of consumption in 1951 and 1952, but an upward swing in 1953.

Demand for building papers in 1975 will depend very largely upon the amount of construction activity that will then be going on. Estimates developed earlier in this chapter indicate the probability of a 72 percent increase in residential construction, during the period 1952-75, and an 80 percent increase in nonresidential construction. It is very likely that demand for building papers will increase more rapidly than the increase of construction activity. On the basis of that likelihood, the estimate of 1975 demand for building papers is placed at 2.8 million tons or about double 1953 consumption.

Consumption Trends and Potential Demand for Paperboard

Apparent annual consumption of all paperboards by major classification of grades during variable periods, 1920-53, is shown in table 33. The increase has been from about 2.3 million tons in 1920 to 13.7 million in 1953.

Prior to the 1920's the paperboard industry was confined largely to container board and bending board. Other grades were developed during the 1920's. Periodic and average annual rates of increase have been computed for the period 1929-53. Those percentage increases are as follow:

Grade classification	Percent increase of consumption 1929-53: For the period	Percent increase of consumption 1929-53: Average annual
Container board	194	4.6
Bending board	260	5.5
Nonbending board	50	1.7
Building board	923	9.8
Other paperboard	307	6.0
All paperboard	217	3.2

During the period 1929-53, consumption of paperboard has increased at the average annual rate of 3.2 percent compounded. The corresponding rate of increase in consumption of paper during that same period was 2.8 percent.

The relationship of paperboard consumption to gross national product during the period 1925-53[89] is shown graphically in figure 9. As in the case of paper, consumption of paperboard decreased to a lesser extent than gross national product during the depression years 1932-34. In the war years (1942-45), consumption of paperboard maintained a closer relationship to gross national product than did paper, but there was some lag. This difference is probably due to greater importance of paperboard as military

[88] Available statistics are for production only. Exports and imports of this class of paper are relatively small. Production and consumption within the United States are approximately equal over a period of years, but not necessarily for any particular year.

[89] Several important grade classifications of paperboard were in the early stage of very rapid development prior to 1925. To have included those years in the regression charted in figure 9 would have exaggerated the increase of paperboard consumption.

TABLE 33.--Apparent annual consumption of paperboard, by principal grade classifications, 1920-53

[Thousand tons]

Year	Container board[1]	Bending board[2]	Nonbending board[2]	Building board	Other paperboard[3]	Total[4]
1920	--	--	--	--	--	2,264
1921	--	--	--	--	--	1,718
1922	--	--	--	--	--	2,156
1923	--	--	--	--	--	2,805
1924	--	--	--	--	--	2,857
1925	1,777	--	--	83	--	3,299
1926	--	--	--	102	--	3,641
1927	2,100	796	444	81	333	3,754
1928	1,985	948	621	80	385	4,019
1929	2,256	991	600	137	319	4,303
1930	1,915	1,013	653	108	229	3,918
1931	1,904	906	562	107	250	3,729
1932	1,592	887	465	65	207	3,216
1933	2,021	958	572	47	375	3,973
1934	1,882	966	591	59	479	3,977
1935	2,358	1,121	624	65	415	4,583
1936	2,756	1,272	701	88	525	5,342
1937	3,168	1,289	720	98	403	5,678
1938	2,631	1,221	609	109	397	4,967
1939	3,318	1,360	865	102	299	5,944
1940	3,334	1,416	899	163	329	6,141
1941	4,149	1,842	1,239	623	436	8,289
1942	3,712	1,712	997	882	570	7,873
1943	4,065	2,047	829	907	737	8,585
1944	4,197	2,116	750	936	934	8,933
1945	4,093	2,270	721	890	886	8,818
1946	4,291	2,708	603	977	903	9,432
1947	4,896	2,758	705	1,064	930	10,313
1948	5,029	2,672	702	1,266	1,056	10,706
1949	4,630	2,613	753	837	1,081	9,906
1950	5,770	3,135	876	1,227	1,249	12,259
1951	6,188	3,272	877	1,276	1,297	12,873
1952	5,673	3,144	783	1,315	1,217	12,109
1953	6,629	3,567	898	1,402	1,298	13,658

[1] For years prior to 1937, production.
[2] Production.
[3] For years 1945-53, production; for other years the data are residuals of total paperboard consumption minus consumption of other grades.
[4] Data in certain lines do not add across on account of rounding, and on account of lack of export-import information for certain grades.

Source: 1920-38 and 1940-41, American Paper and Pulp Association, STATISTICS OF PAPER, 1954 edition, compiled from reports of Bureau of the Census, U. S. Department of Commerce; 1939 and 1942-53, Bureau of the Census, U. S. Department of Commerce.

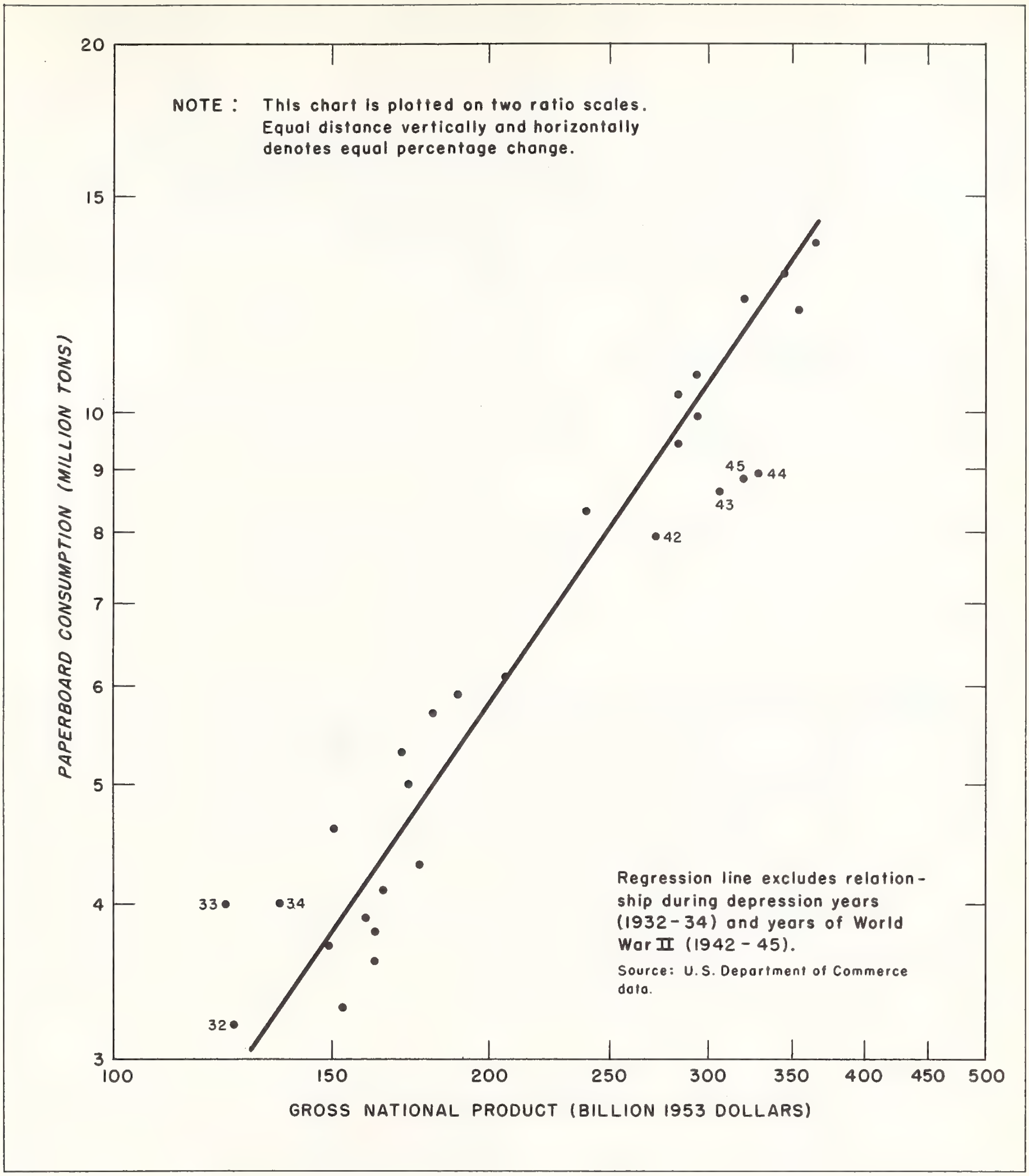


Fig. 9 - Relationship of paperboard consumption to gross national product 1925-53.

materiel. After the war was over, consumption of paperboard and gross national product returned to their long-term relationship.

While the relationship of paperboard consumption to gross national product in the period 1925-53 has been quite consistent, it is realized that any statistical projection based on a period in which so many new uses for paperboard were in their developmental stage would be expected to greatly overstate the actual demand potentialities. The projection procedure has, therefore, been modified by use of population and gross national product as the independent factors of the projection. On that basis, the indicated 1975 demand for paperboard is 27.5 million tons, and the indicated 2000 demand is 52.9 million. Subsequent analyses of 1975 demand by major classifications led to a reduction of the 1975 demand estimate to 27 million tons and of the year-2000 estimate to 45 million.

Allocation of 1975 Demand Estimate to Major Grade Classifications

Allocation of the estimated total 1975 demand for paperboard to major grade classifications has been done largely on the basis of consumption trends and consideration of the principal factors that are most likely to influence future demand.

Container board: Apparent consumption of container board has increased from 2.3 million tons in 1929 to 6.6 million in 1953, an increase of 194 percent (table 33). The bulk of this material is used for fiber packing cases and cartons.

With the exception of the depression years 1930-34, consumption has increased rapidly at a rather steady rate. The years of World War II are no exception to this statement.

Consumption of container board has increased at a somewhat faster rate than gross national product. This, of course, has been due to the displacement of nailed wooden boxes by fiber packing cases and cartons. Since a large part of that displacement has already occurred, it is unlikely that container board consumption will continue to increase quite as rapidly in the future as it has since 1929. There is, however, the definite possibility that container board capable of withstanding high humidity and water condensation will be perfected and become available at low cost. In that event, the field of usefulness for fiber packing cases would be expanded still further.

With due consideration of these factors, the estimate of 1975 demand for container board has been placed at 11 million tons or approximately double 1953 consumption.

Bending Board: Bending board is one of the newer paperboard products. This material is used largely for packaging consumer goods. Cereal boxes, frozen food wrappers, paper milk cartons, tooth paste tube boxes, and hundreds of similar packages are made of bending board.

Consumption of bending board increased from 796 thousand tons in 1927 (first year for which data are available) to 3.6 million tons in 1953. The trend has been very similar to that of container board, except that there was less of a decline in consumption during the depression years.

Demand for bending board can be expected to increase (as it has in the past) at about the same rate as demand for container board. Bending board is used for the small customer-size packages that are shipped in container-board packing cases. The modern trend toward increased pre-packaging of all types of consumer goods may tend to increase the demand for bending board at a somewhat faster rate.

On the basis of that assumption, the estimate of 1975 demand for bending board has been placed at 8 million tons.

Nonbending board: Nonbending board is one of the older paperboard products. Some typical uses of this material include: boxes for single pairs of shoes, hat boxes, paperboard filing boxes, and the paperboard part of cloth-bound book covers. This class of paperboard frequently contains a high percentage of pulp recovered from waste paper--especially newspapers.

Consumption of nonbending board increased from 444 thousand tons in 1927 to 898 thousand in 1953, an increase of 102 percent. Consumption of this class of paperboard reached a peak of 1.2 million tons in 1941. It then declined to 603 thousand tons in 1946, but rose again rather steadily in subsequent years to 898 thousand tons in 1953.

The principal reason for this peculiar consumption trend is displacement of nonbending board by bending board in a number of important uses. The box made of nonbending board is normally set up in the factory and shipped to the user in that form. Such shipments are bulky, require rigid packing cases, and occupy a considerable amount of storage space. For a number of uses these disadvantages cannot very well be avoided. Hats, for instance, require a rigid package to keep them from being crushed out of shape. But many other articles can be packed in a less rigid container made of bending board. These bending board containers are shipped from the factory to user, flattened out. They require less protection in shipment and they occupy less storage space.

With respect to many other uses, of course, nonbending board has been entirely satisfactory. While any estimate of 1975 potential demand for nonbending board is attended with more-than-average uncertainty, a moderate increase can reasonably be anticipated. The estimate offered here is 1.5 million tons or 67 percent more than was consumed in 1953.

Building board: The term "building board" as used in Census Bureau paperboard statistics includes a variety of products ranging all the way from very low-density acoustical tile to the high-density hardboards. Because the mix of these products has changed quite radically in recent years, interpretation of the statistics on total production (or consumption) of the building boards is rather difficult. The historical series measures building board on a tonnage basis. But high-density hardboards which have been produced in rapidly-increasing quantity since the early 1940's greatly outweigh other types of building boards on a cubic-foot or square-foot basis. This factor introduces a bias in the total tonnage figures and limits their significance.

Consumption of hardboard having a density of more than 26 pounds per cubic foot during certain years 1939-53 has been estimated as follows:[90]

	Consumption of Hardboard (million sq. ft. 1/8-inch basis)
1939	216
1944	471
1947	746
1950	945
1951	991
1952	1,094
1953	1,214

[90] United States Tariff Commission, HARDBOARD, REPORT ON INVESTIGATION CONDUCTED PURSUANT TO RESOLUTION BY SENATE COMMITTEE ON FINANCE DATED AUGUST 9, 1954, Washington, D. C., 1955, page 34.

Consumption of this type of building board increased by 462 percent within the time-span of 14 years. On a tonnage basis, the 1953 output of hardboard amounted to 423 thousand tons,[91] or about 33 percent of 1953 building-board consumption. The past decade, of course, has been a developmental period stimulated in part by the expiration of certain patents theretofore held by one company. Comparable percentage increases in consumption would not be expected to continue indefinitely.

Returning now to the data that are available on total apparent consumption of building board (table 33), the trend prior to 1940 is only slightly upward with many violent fluctuations. Since 1940 the tonnage figures show a steep upward trend, but most of that can be accounted for by the rapid increase of hardboard production.

Because of the limited significance of tonnage figures over the past 10 to 15 years, the estimate of 1975 demand for building board has been based on the anticipated increase of construction activity during the period 1952-75. If residential construction increases by 72 percent, and nonresidential construction increases by 80 percent, and building boards displace lumber or plywood (or both) to a considerable extent, demand for building board might be expected to be more than double 1953 consumption. On that basis, the estimate has been placed at 3.5 million tons.

Other paperboard: "Other paperboard" is a classification that includes an assortment of products such as stock used for fiber tubes, drums, and cans; egg case filler board, liner for gypsum and plaster board, and a number of other items.

Consumption of boards in this classification increased from 333 thousand tons in 1927 to 1.4 million tons in 1953. Prior to 1940 there was a slight upward trend in consumption but with many sharp fluctuations. Since that time consumption has increased steadily and rapidly.

Because of the peculiarities of the past consumption trend (virtually no increase from 1928 to about 1940 with rapid and sustained increase thereafter) any statistical method of projection would be of doubtful validity. About half of the tonnage of products in this classification appear to be associated with construction and the other half are container materials. Assuming a considerable increase in use of such materials as substitutes for wood in other forms, 1975 demand is estimated at 3 million tons or approximately double 1953 consumption.

Summary of Estimated Demand for Paper and Paperboard

The various estimates of 1975 potential demand for paper and paperboard by major classifications, and the estimates of year-2000 demand for all paper and paperboard, are now brought together in a summary tabulation. Consumption in 1952 is also shown for reference purposes:

	1952 Consumption	1975 Demand	2000 Demand
	- - - - - - million tons	- - - - -	
Newsprint paper	5.9	9.3	--
Groundwood, except newsprint	.8	1.5	--
Book, fine, and absorbent paper	4.0	7.4	--
Coarse and industrial paper	3.5	7.0	--
Tissue and sanitary paper	1.4	3.0	--
Building paper	1.3	2.8	--
All paper	16.9	31.0	50.0

[91]Bureau of the Census, FACTS FOR INDUSTRY, WOOD PULP, PAPER AND BOARD, 1953, Washington, D. C., 1954, page 8.

	1952 Consumption	1975 Demand	2000 Demand
	- - - - - - million tons	- - - - -	
Container board	5.7	11.0	--
Bending board	3.1	8.0	--
Nonbending board	.8	1.5	--
Building board	1.3	3.5	--
Other board	1.2	3.0	--
All paperboard	12.1	27.0	45.0
Total, paper and paperboard	29.0	58.0	95.0

The estimated 1975 demand for paper is 83 percent above 1952 consumption; estimated year-2000 demand is 225 percent above. The corresponding percentage increases indicated by the paperboard demand estimates are 123 for the 1952-75 period and 272 for the period 1952-2000. For all paper and board, they are 100 for the 1952-75 period and 228 for the period 1952-2000.

Anticipated Net Imports of Paper and Paperboard

With respect to newsprint paper, the United States has had a comparatively large net import for many years (table 34). With respect to all other classifications of paper and paperboard, the United States has had a relatively small net export. Only in 1923 and 1924 was there a net import of products other than newsprint.

The bulk of the newsprint imports of the United States are from Canada. Because of the special advantages that Canada has as a newsprint producer (large supply of the preferred species of timber, low-cost hydroelectric power favorably located with reference to the timber resource, waterways that permit the easy floating of pulpwood from forests to mills), it is to be expected that imports by the United States will increase.

On the basis of past trends and present outlook, it has been estimated that net imports of newsprint paper will be somewhere near 7 million tons by 1975. The same net import is assumed for 2000. On the basis of the estimated total United States demand for newsprint (9.3 million tons), this net-import figure implies that domestic production will increase to 2.3 million tons. That quantity would be about double 1953 domestic output.

Since United States international trade in other grades of paper and paperboard (in net-export terms) is comparatively minor (table 34), no further adjustment between estimated 1975 demand for paper and paperboard and estimated demand on domestic paper and paperboard production has been made.

Potential Demand for New Wood Pulp

Previous estimates have dealt with potential 1975 and year-2000 demand for paper and paperboard. The estimate of 1975 demand has been allocated to the major grade-classifications of paper and paperboard. Anticipated net imports of newsprint paper have been mentioned. The next step is to estimate the amount of new wood pulp that would probably be necessary in the manufacture of 51 million tons of paper and paperboard in 1975 and 88 million tons in 2000. A further estimate of wood pulp demand for manufacture of nonpaper products will be made.

Pulp for Paper and Paperboard

The 1975 requirement for new wood pulp will be considered on the basis of paper and paperboard grade-classifications, but the year-2000 requirement will not go beyond a rough estimate of wood pulp required for all paper and for all paperboard.

TABLE 34.--United States net imports of newsprint paper and of other paper and paperboard, net exports of paper other than newsprint and of paperboard, net import position with respect to international trade in paper and paperboard, 1920-53

[Thousand short tons]

Year	Net imports		Net exports other paper and board	Net import position
	Newsprint	Other paper and board		
1920	684	--	230	454
1921	776	--	82	694
1922	1,003	--	13	990
1923	1,293	30	--	1,323
1924	1,340	11	--	1,351
1925	1,425	--	10	1,415
1926	1,832	--	42	1,790
1927	1,975	--	52	1,923
1928	2,146	--	98	2,048
1929	2,404	--	133	2,271
1930	2,270	--	121	2,149
1931	2,057	--	92	1,965
1932	1,784	--	55	1,729
1933	1,783	--	57	1,726
1934	2,187	--	85	2,102
1935	2,361	--	82	2,279
1936	2,737	--	62	2,675
1937	3,300	--	109	3,191
1938	2,269	--	107	2,162
1939	2,601	--	162	2,439
1940	2,719	--	445	2,274
1941	2,912	--	253	2,659
1942	2,877	--	180	2,697
1943	2,600	--	199	2,401
1944	2,451	--	189	2,262
1945	2,622	--	327	2,295
1946	3,462	--	229	3,233
1947	3,928	--	281	3,647
1948	4,365	--	180	4,185
1949	4,595	--	216	4,379
1950	4,819	--	183	4,636
1951	4,892	--	375	4,517
1952	4,928	--	329	4,599
1953	4,957	--	202	4,755

Source: 1920-38 and 1940-44, American Paper and Pulp Association, STATISTICS OF PAPER, New York, N. Y. (compiled from Bureau of Census data). 1939 and 1942-53, U. S. Department of Commerce, Bureau of the Census.

Figure 7 (above) shows the relation of the various fibrous materials used in the production of paper and paperboard in the United States during 1952. The composition of that total fibrous-material intake was as follows:

	Million tons	Percent
New wood pulp	17.3	66
Waste paper	7.8	30
Other non-wood fiber	1.2	4
Total	26.3	100

The quantity of new wood pulp required per ton of paper and paperboard produced varies greatly from grade to grade and from one grade-classification to another. Since the estimates of 1975 demand for paper and paperboard are made by grade-classification only, the indicated requirements for new wood pulp will also be by grade-classification of paper and paperboard.

Information available at the time this chapter is being written covers two years only, and is somewhat out of date; but no other national average data are available.[92]

	Quantity of New Wood Pulp Consumed per Ton of Paper and Paperboard Output	
	1943-44 (tons)	1947 (tons)
Newsprint	1.05	1.01
Groundwood, except newsprint	--	1.01
Book, fine, and absorbent paper	--	.75
Coarse and industrial paper	.97	1.00
Tissue and sanitary paper	.95	.94
Building paper	.19	.28
All paper	--	.83
Container board	.55	.56
Bending board	--	.24
Nonbending board	--	.02
Building board	.63	.80
Other board	.24	.18
All paperboard	--	.43
Paper and paperboard, combined	--	.63

In 1947 new wood pulp represented 63 percent of all fibrous material used in paper and paperboard manufacture. By 1952, as noted above, 66 percent was new wood pulp.

The estimates of the 1975 new wood pulp requirement are based on the 1947 factors shown above, with some minor adjustments to take account of expected shifts within grade-classifications. Those estimates are as follow:

[92] Sources: 1943-44, War Production Board, unpublished memorandum No. WPBJ-2622 12/19. Data for 1947 from CENSUS OF MANUFACTURERS: 1947 PULP, PAPER, AND BOARD, MC26A, Washington D. C., 1949, page 16.

(--) indicates that classification in 1943-44 information does not fit that for 1947.

	1975 New Wood Pulp Requirement (thousand tons)
Newsprint (domestic production only)	2,300
Groundwood, except newsprint	1,500
Book, fine, and absorbent paper	5,600
Coarse and industrial paper	7,000
Tissue and sanitary paper	2,800
Building paper	700
All paper	19,900
Container board	6,600
Bending board	2,400
Nonbending board	30
Building board	2,800
Other board	600
All board	12,430
All paper and board	32,330
Anticipated net imports of newsprint, wood pulp equivalent	7,070
Total requirement for paper and paperboard	39,400

Further analyses based on the 1947 distribution of the types of new wood pulp used in domestic production of each class of paper and paperboard (with adjustments to take account of recent and expected trends), leads to the following breakdown by type of the estimated wood pulp requirement for domestic production of paper and board by 1975:

	Wood-Pulp Requirement		
	For paper	For paperboard	Total
	- - - - thousand tons - - - -		
Sulfite	5,000	700	5,700
Sulfate	8,800	6,740	15,540
Soda	550	50	600
Groundwood	3,810	1,400	5,210
Semichemical and other	1,740	3,540	5,280
Total	19,900	12,430	32,330

The wood pulp requirement for production of the anticipated net import of newsprint paper (7 million tons) would probably include about 4,900 thousand tons of groundwood, 700 thousand tons of sulfite,[93] 700 thousand tons of sulfate, and 770 thousand tons of semichemical pulp.

[93] This conversion is made in order to provide a later estimate of the net imports of paper in terms of pulpwood equivalent.

Wood Pulp for Products other than Paper and Board

The consumption of wood pulp in production of rayon in the United States 1930-53 has been as follows:[94]

Year	Thousand tons	Year	Thousand tons
1930	45	1942	281
1931	53	1943	281
1932	43	1944	285
1933	65		
1934	63	1945	297
		1946	323
1935	86	1947	397
1936	104	1948	435
1937	132	1949	349
1938	110		
1939	145	1950	456
		1951	516
1940	178	1952	485
1941	215	1953	522

In 1930 wood pulp comprised 62 percent of the cellulose material consumed in the domestic manufacture of rayon. By 1953 it comprised 87 percent. There is every reason to expect that the output of rayon will continue to increase. That rate of increase (percentagewise) may be slower because rayon is now confronted by competition from other synthetic fibers. There is, of course, the possibility of further displacement of cotton fiber by rayon. About 20 percent of all textile fiber consumed in the United States, in recent years, has been rayon.

Consumption of wood pulp in the manufacture of other products has also been increasing rapidly. The Department of Commerce has reported 1953 consumption of special alpha and dissolving pulps (including that used for rayon) at 713 thousand tons, and of all other pulps at 86 thousand tons, making a total of 799 thousand tons.[95] It is very probable that reporting was incomplete. Actual consumption in all products other than paper and board was probably about 900 thousand tons.

Assuming further rapid increase in the use of pulp for production of such products, the estimate of 1975 demand is placed at 2 million tons, or more than double 1952 consumption. Of this total, 1.5 million tons might be sulfite and 0.5 million might be sulfate.

Anticipated Net Imports of Wood Pulp

The United States has been an importer of wood pulp for many years. While there has always been some export too, the quantity has been relatively small. The annual figures on United States international trade in wood pulp are shown in table 35.

Observing that there has been a definite upward trend in net imports of wood pulp, the 1975 net import is estimated at 3 million tons. Of this total, 1.5 million might be sulfite, 1.0 million might be sulfate, and 0.5 million might be groundwood.

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[94] Textile Economics Bureau, TEXTILE ORGANON, New York, N. Y. (monthly periodical).

[95] U. S. Department of Commerce, PULP, PAPER AND BOARD, March 1955, page 16.

TABLE 35.--United States imports and exports of wood pulp 1920-52

[Thousand short tons]

Year	Imports	Exports	Net Imports
1920	906	32	874
1921	697	28	669
1922	1,259	25	1,234
1923	1,383	23	1,360
1924	1,523	32	1,491
1925	1,664	38	1,626
1926	1,731	34	1,697
1927	1,676	32	1,644
1928	1,755	33	1,722
1929	1,881	54	1,827
1930	1,830	48	1,782
1931	1,596	53	1,543
1932	1,482	48	1,434
1933	1,942	79	1,863
1934	1,806	143	1,663
1935	1,933	172	1,761
1936	2,278	193	2,085
1937	2,395	323	2,072
1938	1,710	140	1,570
1939	2,026	140	1,886
1940	1,225	481	744
1941	1,158	329	829
1942	1,237	378	859
1943	1,306	301	1,005
1944	1,072	218	854
1945	1,754	135	1,619
1946	1,805	39	1,766
1947	2,322	130	2,192
1948	2,176	94	2,082
1949	1,763	122	1,641
1950	2,385	96	2,289
1951	2,361	200	2,161
1952	1,937	212	1,725
1953	2,156	162	1,994

Source: 1920-38 and 1940-41. United States Pulp Producers Association, WOOD PULP STATISTICS (compiled from Bureau of the Census data); 1939 and 1952-53, Bureau of the Census, U. S. Department of Commerce.

Estimated Total Requirements for Wood Pulp

The estimated total 1975 requirements for wood pulp based on estimates of demand for paper and board and for the nonpaper products of wood pulp are summarized in table 36. Estimated total wood-pulp requirement includes the wood pulp equivalent of the anticipated net imports of paper. Anticipated net imports of wood pulp are listed by type. The final column of table 36 indicates estimated 1975 domestic demand for domestic wood pulp production--assuming paper and wood-pulp net imports at the anticipated levels.

The estimate of year-2000 demand for pulpwood (90 million cords) has been made directly from estimated demand for paper and paperboard. This interconnecting analysis of wood pulp requirements in 1975 has served as a guide in making the more generalized estimate of pulpwood demand in 2000.

Estimated Potential Demand for Pulpwood, 1975 and 2000

The quantity of wood pulp obtainable from a cord of wood depends upon the pulping process that is used and also upon the density and other physical characteristics of the pulpwood itself. For a number of years the Bureau of the Census has collected information on the national consumption of pulpwood by pulping process. Based on that information, the following factors for "average cords of pulpwood consumed per ton of wood pulp produced" have been computed.[96]

Year	Sulfite	Sulfate	Soda	Groundwood	All others	Average for all processes
	- - -	- - -	-cords of wood	per ton of pulp-	- - -	- - -
1935	1.97	1.65	--	.93	--	1.55
1936	1.91	1.64	--	.93	--	1.53
1937	2.02	1.67	1.76	.92	.76	1.58
1938	1.92	1.65	1.82	.91	.91	1.55
1939	1.90	1.64	1.73	.91	.95	1.55
1940	1.90	1.59	1.84	.97	.94	1.53
1947	2.01	1.77	1.95	.98	1.02	1.62

Using these factors as a guide, the estimates of 1975 wood pulp requirements were converted to corresponding estimates of pulpwood.

The pulpwood equivalents of anticipated net imports of paper and of wood pulp are as follow:

	Pulpwood Equivalent (million cords)
Net imports of paper	7.3
Net imports of wood pulp	4.7
Total paper and pulp	12.0

The pulpwood equivalents of the estimated 1975 demand for domestically-produced wood pulp, by grades of pulp, are as follow:

[96] United States Pulp Producers Association, WOOD PULP STATISTICS, 1954 edition, New York, N. Y., page 121.

TABLE 36.--Estimated 1975 demand for wood-pulp products in terms of wood pulp and wood-pulp equivalent, anticipated net imports of paper in terms of wood-pulp equivalent, anticipated net imports of wood pulp, estimated domestic production of wood pulp; by type of pulp

Type of pulp	Total requirement	Net imports of paper	Net imports of wood pulp	Requirement from domestic mills
	1,000 tons	*1,000 tons*	*1,000 tons*	*1,000 tons*
Sulfite	7,900	700	1,500	5,700
Sulfate	16,740	700	1,000	15,040
Soda	600	--	--	600
Groundwood	10,110	4,900	500	4,710
Semichemical and other	6,050	770	--	5,280
Total	41,400	7,070	3,000	31,330

	Pulpwood (million cords)
For sulfite	10.8
For sulfate	24.0
For soda	1.1
For groundwood	4.2
For semichemical and other	4.2
Total	44.3

Net imports of pulpwood over the period 1935 to 1953 have varied between 1 and 2 million cords (table 31, above). It has been assumed that there will be a net import of about 2 million cords in 1975. On that basis, the indicated 1975 demand on domestic forests for pulpwood has been estimated at about 42.3 million cords. Total demand for pulpwood including the anticipated net imports of pulpwood, and pulpwood equivalent of net imports of wood pulp and paper would amount to approximately 56.3 million cords.

Assuming a considerable shift toward the use of the dense hardwoods, increasing re-circulation of wood fiber in paper and paperboard production through greater use of waste-paper pulp, and increased use of the high-yield pulping processes, the estimate of year 2000 pulpwood demand has been placed at 90 million cords. With these technological advances, it is reasonable to think that these 90 million cords would be sufficient wood to provide 50 million tons of paper, 45 million tons of paperboard, and to quadruple the production of nonpaper products of wood pulp. Net imports of pulpwood, wood pulp and paper in 2000 have been assumed to total 14 million cords--pulpwood equivalent. Demand on domestic forests is estimated at 76 million cords.

With the advent of the sulfate, the semichemical, and the chemigroundwood pulping process, the pulp manufacturing industry has obtained a rather large freedom in the choice of species that it will use. The softwood-hardwood distribution of pulpwood that will be demanded in 1975 and 2000 is likely to be determined more by the supply factors than by the demand factors. Knowing that hardwood suitable for pulpwood is likely to be more plentiful in 1975 and 2000 than softwood, the following estimates of potential demand for domestic pulpwood assume a marked swing toward hardwood:

	Softwood (million cords)	Hardwood (million cords)	All species (million cords)
1952 Consumption---------------	21.4	3.7	25.1
1975 Demand--------------------	32.3	10.0	42.3
2000 Demand--------------------	53.0	23.0	76.0

Further development of this estimate in terms of roundwood volume and indicated demand on growing stock and live sawtimber has already been done in the initial summary of these lower-level estimates of potential demand for timber (pages 51-55 of this chapter).

ESTIMATES OF POTENTIAL DEMAND FOR VENEER LOGS AND BOLTS

The veneer and plywood industry has experienced a remarkable growth during the past fifty years. Measured in terms of the volume of logs and bolts processed annually, it has expanded from 329 million board feet in 1906 to 2,815 million in 1953 (table 37). It has doubled, redoubled, and more than redoubled again in 47 years.

Actually, there are two quite separate industries converting timber to veneer and plywood. The products of one compete with the products of the other to a considerable extent; but each has a rather large domain of uses in which the other does not compete. Analysis of potential demand can proceed best by considering the softwood plywood and veneer industry and the hardwood plywood and veneer industry separately.

Softwood Plywood and Veneer

The softwood plywood industry, located in the Pacific Northwest and California, is based principally on Douglas-fir, but the use of ponderosa pine, western hemlock, and some other species is increasing. About 95 percent of the volume of logs processed in 1953 were utilized for plywood veneer. The rest was utilized for container veneer (table 38).

Important savings of labor have been made in residential construction by use of softwood plywood for roof and wall sheathing, subflooring, inside wall coverings, and exterior siding. The last two uses mentioned are most prevalent in prefabricated housing, for which plywood is a favored material. About 77,000 prefabricated houses were erected in 1954. This represented about 6.3 percent of the nonfarm dwelling units built in that year.

The chief use of softwood plywood in nonresidential construction has been in concrete forms for buildings, bridges, dams, and other structures. Such forms are particularly suitable where smooth or curved surfaces are desired. The moisture-proof and moisture-resistant types of plywood now available can be used a number of times in erection of concrete forms.

Softwood plywood is being used to some extent in farm service buildings. It is being used extensively as lining and as exterior material for railroad freight cars and truck-trailer bodies. House trailers are being lined with plywood and furnished with plywood fixtures.

Estimates of Consumption and Demand by Major End-uses

Information on the end-use distribution of softwood plywood consumed is exceedingly scarce. A survey, conducted by the Forest Service, of wood used in manufacture during 1948 shows that 723 million square feet (3/8-inch equivalent) of softwood plywood

TABLE 37.--Estimated volume of logs and bolts consumed in manufacture of veneer and plywood in specified years, 1906-53

[Million board feet, log scale]

Year	All species	Softwood	Hardwood
1906	329	52	277
1907	349	39	310
1908	383	51	332
1909	436	56	380
1919	577	93	484
1921	400	70	330
1923	646	151	495
1925	735	194	541
1927	962	290	672
1929	1,113	394	719
1931	696	228	468
1933	700	282	418
1935	824	340	484
1937	1,114	460	654
1939	1,194	544	650
1942	1,736	797	939
1943	1,594	659	935
1944	1,533	647	886
1945	1,404	546	858
1947	1,570	751	819
1951	2,271	1,232	1,039
1952	2,467	1,548	919
1953	2,815	1,861	954

Source: U. S. Department of Commerce data republished in: (1906-33) Sowder, A. M. and Marquis, R. W., TIMBER REQUIREMENTS FOR VENEER AND PLYWOOD, Forest Service, Washington, D. C., 1941, page 8; (1935-47) Forest Service, Materials Survey, Washington, D. C., 1950, Table 48; (1951 and 1953) U. S. Department of Commerce, FACTS FOR INDUSTRY, SOFTWOOD PLYWOOD AND VENEER, SUMMARY FOR 1951, page 7, and SUMMARY FOR 1953, page 2; FACTS FOR INDUSTRY, HARDWOOD VENEER 1952, page 3, and HARDWOOD VENEER, 1953, page 3; (1952) Department of Commerce data adjusted to include log consumption of "green veneer" mills.

and container veneer was used in the fabrication of containers, fixtures, furniture, and various other nonconstruction items (table 39).[98] That 723 million square feet represented 37 percent of the reported production of softwood plywood in 1948 (table 40).

Making allowance for some increase in use of plywood in fabrication of these manufactured products, and assuming a 15 percent increase in output of such products between 1948 and 1952, would indicate that the quantity of plywood consumed in these nonconstruction uses by 1952 may have been about 900 million square feet. That 900 million square feet would represent 28 percent of the reported production of softwood plywood in 1952. Because of the large increase of construction activity between 1948 and 1952, it is

[98] Because softwood container veneer represents only 5 percent of all softwood logs and bolts consumed by the softwood sector of the veneer and plywood industry, no attempt has been made in this study to make separate estimates for softwood container veneer.

TABLE 38.--Volume of logs and bolts processed by the softwood plywood and veneer industry in 1953

Use and species	Volume	Distribution
	Million bd. ft.	*Percent*
Utilized for plywood veneer		
Douglas-fir	1,686	91
Ponderosa pine	58	3
Other species	28	1
Total for plywood	1,772	95
Utilized for container veneer		
Douglas-fir	57	3
Ponderosa pine	1	[1] --
Other species	31	2
Total for container	89	5
Total volume processed		
Douglas-fir	1,743	94
Ponderosa pine	59	3
Other species	59	3
All species	1,861	100

[1] Less than 0.05 of one percent.

Source: U. S. Department of Commerce, FACTS FOR INDUSTRY, SOFTWOOD PLYWOOD AND VENEER, 1953, Washington, D. C., 1954, page 2.

reasonable to believe that a larger percentage of plywood was going into that use in the latter year. It is therefore estimated that about 72 percent of the softwood plywood produced in 1952, or about 2,260 million square feet, were used for construction purposes.[99]

Softwood plywood is a substitute for lumber. It is probably safe to assume that the 1952 percentage of construction plywood used for new residential construction, for new nonresidential construction, and for maintenance and repair, was similar to the corresponding 1952 percentage distribution of lumber used for construction purposes. The 1952 distribution of softwood plywood consumption has accordingly been estimated as follows:

	Million sq. ft.	Percent
New residential construction-----	1,243	40
New nonresidential construction--	452	14
Maintenance and repair construction------------------------	565	18
All construction uses -------	2,260	72
Nonconstruction uses -----------	900	28
Total domestic consumption -	3,160	100

[99]These two estimates do not quite equal reported production in 1952 because there is a small net export of softwood plywood.

TABLE 39.--Consumption of softwood plywood and veneer in the manufacture of specified products, 1948.

[Million square feet 3/8-inch equivalent]

Product	Quantity
Containers	312
Fixtures	149
Furniture	76
Motor vehicles[1]	30
Radios and phonographs	24
Housetrailers	22
Trunks and other luggage	17
Railroad freight cars	14
Electrical equipment	13
Small boats and ships	12
Woodenware and novelties	12
Signs and displays	9
Kitchen cabinets and refrigerators	7
Patterns	5
Cigar and tobacco boxes	4
Other items[2]	17
Total consumption	723

[1] Chiefly motor-truck and truck-trailer bodies.
[2] Does not include plywood used in fabrication of millwork or prefabricated houses and other structures.

Source: Forest Service, WOOD USED IN MANUFACTURE, 1948, Washington, D. C., 1951, page 28. Volumes converted from square feet one-inch equivalent.

Demand for use in construction: Potential demand for softwood plywood in construction uses has been estimated on the basis of the construction-activity projections developed earlier in this chapter. Those projections converted to an index (1952 = 100) are as follow:

Year	New residential	New nonresidential	Maintenance and repair
1952------	100	100	100
1975------	172	180	155
2000------	188	309	244

Assuming, for a first approximation, that the average softwood plywood content per new dwelling unit constructed, and that average use per dollar of expenditure for new nonresidential construction and for maintenance and repair, would remain as in 1952 (and construction activity increased about as projected above), the 1975 and year-2000 demand for softwood plywood would be as follows:

TABLE 40.--Production of softwood plywood, specified years, 1939-54

[Million square feet 3/8-inch equivalent]

Year	Quantity produced	Index
1939	1,032	100
1941	1,805	175
1942	1,840	178
1943	1,495	145
1944	1,485	144
1945	1,222	118
1946	1,436	139
1947	1,700	165
1948	1,954	189
1949	1,977	192
1950	2,676	259
1951	2,995	290
1952	3,178	308
1953	3,848	373
1954	3,933	381

Source: U. S. Department of Commerce: (1939-42) BUSINESS STATISTICS, 1953 edition, page 155: (1943-51) STATISTICAL ABSTRACT OF THE UNITED STATES, 1954 edition, page 728; (1952-53) FACTS FOR INDUSTRY, SOFTWOOD PLYWOOD AND VENEER, 1953, page 2; (1954) SURVEY OF CURRENT BUSINESS, February, 1955, page S-32.

Year	New residential	New nonresidential	Maintenance and repair	All construction
	Million square feet 3/8 inch equivalent			
1952----------	1,243	452	565	2,260
1975----------	2,138	814	876	3,828
2000----------	2,337	1,397	1,379	5,113

The increase of demand for softwood plywood in construction indicated by this method of estimation would amount to 69 percent during the period 1952-75, and to 126 percent during the period 1952-2000. While both periodic increases would be quite large, they are comparatively modest alongside the rate at which softwood plywood production (and consumption) has been increasing over the past fifteen years (table 40, above). During that brief period the output of this material increased by 281 percent.

The idea that demand in the long run for softwood plywood in construction may not increase very much faster than the anticipated increase of construction activity is based on the prospects of strong competition by the new wood-fiber boards, made chiefly from low-cost mill residues and from low-quality timber. As high-quality old-growth timber becomes scarcer and more expensive, the raw-material-cost advantages of the wood-fiber-board industry will become important. There is also a probability of intensified competition between plywood and paperboards--particularly by resin-impregnated boards which can be manufactured to meet a wide range of specifications. Some of this technology, of course, can also be utilized by the manufacturers of plywood. A number of them have already begun to improve and modify their product by use of paper and plastic facings and by other treatments. A period of intense competition among the producers of softwood plywood, of wood-fiber boards, and of paperboards is in the offing. Who will get the lion's share of the markets of the future is a matter of great uncertainty.

There is no reason to believe, however, that softwood plywood will fail to retain its present place as a construction material nor to make some gains at the expense of lumber. Allowing for a moderate expansion in the use of plywood in construction and for the anticipated increases in volume of construction industry output, potential demand for softwood plywood in this field of use is estimated at 4,200 million square feet (3/8-inch equivalent) by 1975, and at 5,500 million by 2000. These estimates imply an increase of 86 percent over 1952 consumption during the period 1952-75, and of 143 percent during the period 1952-2000.

Demand for use in manufacture: It has been estimated above that 900 million square feet of softwood plywood and container veneer were consumed in 1952 in fabrication of containers, fixtures, furniture and various other products listed in table 39 above.

Projecting demand for these products on about the same basis as was done previously in the analysis of lumber used in manufacture (pages 73-82 of this chapter), but assuming a moderate increase in use of plywood per unit of product manufactured, indicates a 1975 potential demand for 1,500 million square feet and a year-2000 demand for 2,800 million square feet.

Softwood Veneer Logs and Bolts

The estimates of 1952 consumption and of 1975 and year-2000 potential demand for softwood plywood and container veneer, and the associated estimates of consumption and demand for softwood veneer logs and bolts are as follow:

	1952	1975	2000
	- - million sq. ft. - -		
Plywood for construction uses	2,260	4,200	5,500
Plywood and container veneer for nonconstruction uses	900	1,500	2,800
All plywood and container veneer	3,160	5,700	8,300
Index	100	180	263
	- - million bd. ft. - -		
Veneer logs and bolts	1,548	2,700	4,000
Index	100	174	258

Recognizing the progress that is being made in recovering more usable veneer from logs and bolts processed, the estimated 1952-75 increase in demand for logs (74 percent) is somewhat less than the estimated increase in demand for plywood and container veneer (80 percent). With respect to the period beyond 1975, the industry will be depending to a large extent upon young-growth timber of smaller size. The possibilities for any further increase in recovery of usable material from logs processed is likely to be rather limited.

Hardwood Veneer and Plywood

The hardwood veneer and plywood industry is widely distributed throughout most of the eastern states. It turns out a variety of products classified as follows:

1. Special-type veneers that meet exacting specifications, such as those used in aircraft and in construction of luxury pleasure boats.

2. Face-type veneers used for decorative effect in quality furniture, or as facing on plywood wall paneling and doors.

3. Commercial and utility-type veneers used in plywood for containers, and for cores and backing of the higher grades of plywood.

4. Container-type veneers used for wirebound boxes and crates, for baskets and hampers, and for other containers in which no gluing is required.

5. Flat-type veneers used for items such as ice cream spoons and sticks, physicians' tongue depressors, and parts of woodenware and novelties.

Of the hardwood veneer produced in 1952, about 16 percent was the special- and face-types. About 49 percent was classified as commercial and utility-type. Container veneers represented 32 percent, and the other 3 percent was flat-type veneers (table 41).

The species distribution of hardwood logs and bolts consumed in 1953 was as follows:[100]

Species group	Million bd. ft. (log scale)	Percent
Birch, beech, cherry, maple, oak, walnut----	188	20
Gum, yellow poplar, basswood, cottonwood---	627	66
Other domestic hardwoods ------------------	111	11
Imported tropical hardwoods ----------------	28	3
Total consumption----------------------	954	100

About 60 percent of the hardwood veneer produced in 1952 was used for manufacture of plywood. That plywood was distributed by types as follows:[101]

Type	Million sq. ft. (surface measure)	Percent
Waterproof --------------	29	2
Moisture-resistant -------	979	69
Container-type -----------	324	23
Dry-bond ----------------	92	6
Total----------------	1,424	100

Hardwood plywood has about the same uses in manufacture as have been mentioned in the case of softwood plywood. The only difference is that the hardwood variety is preferred where appearance, hardness, and sonic properties are important. It is probably less vulnerable to competition by wood-fiber boards than is softwood plywood.

Because the uses of hardwood veneer and plywood are so highly diversified, detailed analysis of potential demand use-by-use is not practicable in this study. The estimated 1975 potential demand for softwood plywood (assuming strong competition by wood-fiber boards and paperboards) has been placed at 80 percent above 1952 consumption. Assuming that hardwood plywood and veneer will not be subject to as strong competition by these other materials, it is probable that demand in the 1952-75 period will increase by 100 percent, and that the 1952-2000 increase will be of the order of 195 percent. With

[100] U. S. Department of Commerce, FACTS FOR INDUSTRY, HARDWOOD VENEER, 1952, Washington, D. C., 1953, page 2. Data on the species distribution of logs consumed in 1952 are not available.

[101] U. S. Dept. of Commerce, FACTS FOR INDUSTRY, HARDWOOD PLYWOOD, SUMMARY FOR 1952, Washington, D. C., 1953, page 2.

TABLE 41.--Production of hardwood veneer 1952, by major types

Type	Quantity	Distribution
	Million bd. ft. surface measure	*Percent*
Special and face veneers	1,666	16
Commercial and utility veneers	4,998	49
Container veneer	3,264	32
Flat veneer	355	3
Total production	10,283	100

Source: U. S. Department of Commerce, FACTS FOR INDUSTRY, HARDWOOD VENEER, 1953, Washington, D. C., 1954, page 2.

a small allowance for improved recovery of usable veneer from the logs and bolts processed, potential demand for hardwood veneer logs and bolts by 1975 is estimated at 1,800 million board feet, and year-2000 demand is estimated at 2,500 million.

Summary of Estimated Demand for Veneer Logs and Bolts

The several estimates of potential demand for veneer logs and bolts are now brought together:

	Softwood	Hardwood	All species
1952 Consumption	1,548	919	2,467
1975 Demand	2,700	1,800	4,500
2000 Demand	4,000	2,500	6,500

In view of the prospective large increase in demand for household furniture, it is anticipated that by 2000 there will be a net import of 500 million board feet of tropical hardwood veneer logs or of the equivalent in veneer and veneer products.

Estimated Potential Demand for Minor Industrial-Wood Products

Industrial-wood products (minor in the sense that no one of them represents a large volume of wood in comparison with lumber, pulpwood, or veneer logs) include cooperage logs and bolts, piling, poles, fence posts, hewn ties, round mine timbers, and a miscellaneous assortment of other products.[102]

The volume of logs and bolts used in production of these minor products in 1952 amounted to 699 million cubic feet, or slightly less than 7 percent of all industrial wood consumed. Brief attention will be given to each of the products listed above. Estimates of 1975 potential demand have been made for each, but the year-2000 estimate has been made only for the group as a whole.

Cooperage Logs and Bolts

The term "cooperage" applies to barrels, kegs, pails, and tubs, made of wood staves and heading, bound together with metal hoops. "Tight cooperage" is used as containers for liquids, and "slack cooperage" is used as containers for dry materials.

[102]Such as bolts for turnery products, wood for making of charcoal, shingle bolts, and furnace poles.

Fifty years ago, tight cooperage was used for storage and shipment of products such as whiskey, beer and ale, wine, molasses, vinegar, pickled products, lard and oils, petroleum products, and chemicals. Out of this list, the only product still stored almost wholly in tight cooperage is whiskey. For the others, there has been a drastic displacement of tight cooperage by metal drums and cans, and by glass containers.

Slack cooperage has been used for storage and shipment of items such as flour, sugar, salt, lime, cement, nails, rosin, and many others. As a container for these materials slack cooperage has been displaced by wooden and fiber boxes, by cotton bags, and by multi-wall paper bags, by fiber drums, and various other containers. Part of the trend away from the slack cooperage container has been due to the practice of putting many commodities in consumer-size packages before they leave the factory. The old cracker barrel, for example, has been replaced by sealed packages containing quantities that the average consumer is willing to buy at one time.

The general trend away from wooden cooperage (both tight and slack) is evident in the figures shown in table 42. In 1906 about 1.5 billion board feet of timber were used in the production of cooperage. In 1952 only 355 million board feet were used for that purpose.

Looking ahead to 1975, it appears likely that the use of cooperage will, by then, be confined almost wholly to storage of whiskey and other spiritous beverages, and to

TABLE 42.--Consumption of timber for cooperage, selected years--1906-51[1]

[Million board feet, log scale]

Year	All cooperage	Tight cooperage	Slack cooperage
1906	1,478	562	916
1908	1,775	682	1,093
1910	1,706	742	964
1919	1,486	725	761
1921	1,149	547	602
1923	1,136	489	647
1925	1,182	544	638
1927	1,307	698	609
1929	1,461	779	682
1931	843	468	375
1933	639	336	303
1935	758	455	303
1937	833	415	418
1939	786	388	398
1947	558	275	283
1949	369	148	221
1950	455	197	258
1951	427	164	263
1952	355	92	263

[1] Data for years 1906-25 from U. S. Forest Service Statistical Bulletin No. 21, "American Forests and Forest Products"; for years 1927-47 from Bureau of the Census, Census of Manufactures; for years 1949-51 from U. S. Department of Commerce, N.P.A., "Containers and Packaging" industry reports. N.P.A. reports on number of barrels converted to timber volume by factor of 41 bd. ft. per barrel for tight cooperage and 12 bd. ft. per barrel for slack cooperage.

packaging of certain materials for export. On the basis of that supposition, potential demand for cooperage logs and bolts in 1975 is estimated at 400 million board feet. While this amount is considerably more than was consumed in 1952, it is less than 1951 consumption and consumption in every other previous year except 1949 (table 42).

The tight cooperage industry is very exacting in its wood requirements, since the woods used must be impermeable to liquids. For certain commodities, it is also essential to use woods that do not impart odor, flavor or color to the contents. White oak has long been favored, especially for whiskey barrels. Slack cooperage need not be made of such high-quality wood as tight cooperage although freedom from odor, flavor and color is sometimes important. Oaks, gums, poplar, southern pines, spruce and Douglas-fir are among the most widely used woods. The proportion of hardwood used is increasing for both tight and slack cooperage and may be expected to continue to do so:

	1950 Consumption (million bd. ft.)	1975 Demand (million bd. ft.)
Softwood-------	161	112
Hardwood------	294	288
Total------	455	400

Piling

Wood piling is used chiefly in construction of dock facilities, as footing for the foundation of buildings erected on ground that contains no hard underlying strata, and for railroad trestles.

Information on the quantity of piling treated in wood preservation plants has been collected for many years, but little is known about the quantity of untreated piling installed from year to year. Partial surveys made in a few areas indicate that about 40 percent of all piling installed may be untreated material. This estimate, however, is subject to considerable margin of error. During the years of World War II, a large volume of untreated piling was installed because dock and other facilities were needed in a hurry, and preservative materials were in short supply. The average annual volume of piling treated during specified periods, and the estimated total consumption of piling are as follows:

Period	Volume treated (million cu. ft.)	Volume consumed (Million cu. ft.)
1925-29----------	12.9	21.5
1930-34----------	10.1	16.8
1935-39----------	11.3	18.8
1940-44----------	21.0	46.6
1945-49----------	12.7	21.2
1950-51----------	14.8	24.7
1952-------------	16.7	28.0

Wood piling will, no doubt, continue to be used for the same purposes it now serves. There will probably be some displacement by steel and concrete, but more important, from the standpoint of future demand, will be the increased use of treated piling. The 1975 potential demand for piling is estimated at 27 million cubic feet or 40 million linear feet. Of this total, about 90 percent would probably be softwood and 10 percent might be hardwood.

Poles

Wood poles are used principally for electric power lines and for telephone and telegraph lines. The number in service has been increasing and is expected to increase still further. The most rapid increase has been in the power-line field.

Class of Utility	Number of poles in service (million)	
	1938	1949
Rural electric cooperatives	0.7	15.0
Other power lines	19.5	32.2
Telephone lines	21.0	25.2
Western Union telegraph	8.8	9.7
Class I Railroads	2.6	4.2
Total in service	52.6	86.3

Because of the great mileage of new power lines installed during recent years, trends in number of poles installed annually are not a very reliable indicator of what the future demand might be. The average annual installation has been as follows:

Period	Average number of poles installed annually (million)
1923-29	3.6
1935-39	3.6
1940-45	3.8
1946-50	6.8
1952	6.5

Assuming that by 1975 there will be 120 million poles in service, with an average service-life of 30 years, and that new lines then being constructed will require 1 million poles annually, the 1975 potential demand for poles is estimated at 5 million. That number would provide 4 million for replacements and 1 million for the new lines. Even though the estimate is 1.5 million less than the number installed in 1952, it appears to be adequate to meet the probable future demand. Practically all poles used are softwood.

Fence Posts

Consumption of wood fence posts in 1952 is estimated at 306 million pieces. Only about two-thirds of the posts used were cut from growing stock on commercial forest land. The balance were obtained from hedgerows, noncommercial forest land and other sources.

Consumption of wood posts has declined sharply in the past 35 years according to Forest Service estimates:

Year	Number used (millions)
1920	900
1929	400
1937	475
1945	250
1952	306

The decline in use of wood posts has resulted partly from greater use of steel and concrete posts, and partly from increased use of wood preservatives. However, farm abandonment, farm consolidation, and decline in use of horses on farms are other factors which also have tended to reduce post consumption. The influence of such factors is being partially offset by farm reorganization for soil conservation, more intensive pasture management, rangeland improvement, and new highway construction.

Potential demand for wood posts in 1975 is estimated at 280 million pieces, or about 8 percent less than consumption in 1952. As at present about 35 percent of the posts used would be softwood and 65 percent hardwood.

Round Mine Timbers

Consumption of round mine timbers in 1952 is estimated at 81 million cubic feet. This was slightly less than the volume of logs used for sawn mine timbers. About three-fourths of the round mine timbers used in 1952 were hardwoods; one-fourth softwoods.

Species use is closely related to local availability. About 90 percent of the timbers are used in coal mining in predominantly hardwood portions of Pennsylvania, the southern Appalachian mountains and the central States.

Consumption of round mine timbers has declined considerably in the past 30 years.

Year	Round mine timber used (million cu. ft.)
1905	166
1923	174
1935	114
1950	108
1952	81

That decline has been due partly to the substitution of sawn material for round mine timbers. Use of steel roof bolts in lieu of mine timbers to support overlying rock in coal mines is a recent development which has further reduced the requirement for round mine timbers. However, the President's Material Policy Commission has estimated that growth of the national economy by 1975 can be expected to increase coal consumption about 54 percent above 1950. Production of other minerals is likewise expected to increase. Thus, total potential demand for round mine timbers in 1975 is estimated at 130 million cubic feet, about three-fourths hardwood.

Other Industrial Wood

An estimated 227 million cubic feet of timber were used in 1952 for a wide variety of products such as charcoal and other wood distillation products, spools, dowels and other turned products, shingles, excelsior, sporting goods, smelter poles, farm poles, round and split farm timber. About half of these products was derived from growing stock while the balance was drawn from cull trees and plant residues, the latter being used primarily for charcoal and small dimension stock. Not included in these estimates are substantial quantities of dead chestnut wood used for tannin extract and of pine stumps used for naval stores.

Past trends in consumption of these minor products have been variable, some increasing and others decreasing. Demand for wood shingles, excelsior, and charcoal has been on the downgrade, but demand for many of the manufactured products made directly from bolts has been increasing. Assuming that the heavier market losses for wood in these miscellaneous uses have already been sustained, 1975 demand is estimated at 280 million cubic feet or 23 percent above 1952 consumption. Of this total, about one-third would probably be drawn from mill residues and from roundwood other than forest growing stock. About half would be softwood.

Summary of the Estimates

The various estimates of 1975 potential demand for the minor industrial-wood products, including a hewn-tie item which was discussed previously in the section pertaining to lumber requirements of the railroads, add up to 711 million cubic feet, roundwood basis (table 43). That volume is less than 2 percent above 1952 consumption.

TABLE 43.--Consumption of minor industrial-wood products 1952; estimate of potential demand 1975 and 2000

Product	Standard units of measure	1952 Consumption	1975 Estimated Demand	Roundwood volume		
				1952 Consumption	1975 Demand	2000 Demand
		Million units	*Million units*	*Million units*	*Million units*	*Million units*
Cooperage logs and bolts	Bd.ft.log scale	355.3	400	73	82	
Piling	Linear feet	41.2	40	28	27	
Poles	Pieces	6.5	5	88	68	Estimate
Fence posts	do	306.0	280	194	178	not
Hewn ties	do	[1] 10.2	[1] 3	67	19	itemized
Mine timbers, round	Cubic feet	81.0	130	81	130	
Other industrial wood	do	227.0	280	[2] 168	[2] 207	
All minor products	do	([3])	([3])	699	711	784

[1] Consumption of hewn ties in 1952, and estimated potential demand for hewn ties were discussed in the section pertaining to lumber used by railroads.
[2] Volume from roundwood only. The difference between these figures and the corresponding "standard unit" volumes represents mill residues converted into these miscellaneous products.
[3] The volumes shown in these two columns are not additive.

The estimate of potential demand at year-2000 is 784 million cubic feet or approximately 10 percent above the estimate for 1975. The larger increase allowed for in the period 1975-2000 is based on the assumption that most of the market losses by products most vulnerable to competition (hewn ties, for example) will have been taken by 1975, and that the increase of population and other factors will tend to expand demand for some of these timber products in the last quarter of the century. This, of course, is a matter of judgment, but even though it should prove to be in error the effect upon the estimates of potential demand for industrial wood as a whole would be negligible.

Of the 699 million (roundwood) cubic feet of timber in the minor industrial-wood products consumed in 1952, 326 million were softwood and 373 million were hardwood. The various shifts in demand anticipated during the period 1952-75 would decrease demand for softwood to 310 million cubic feet and increase demand for hardwood to 401 million cubic feet. It has been assumed that the softwood-hardwood distribution of the estimated year-2000 demand would be about the same as for 1975. On that basis, year-2000 demand is estimated at 353 million cubic feet of softwood and 431 million of hardwood.

ESTIMATED DEMAND FOR FUELWOOD

Estimates of 1952 consumption and of 1975 and year-2000 demand for fuelwood, broken down by major sources, have previously been discussed in this chapter (page 46 and table 16).

The large drop in fuelwood consumption during the past few decades in the face of a substantial increase in population has been due to greater use of more convenient and efficient fuels such as coal, oil, gas, and electricity.

Use of wood for curing tobacco and for certain industries such as brickyards has declined sharply as a result of substitution of other fuels. Since 1941 the decline in use of fuelwood in homes has been particularly rapid as the result of changes in both heating and cooking fuels. Between 1940 and 1950, for example, the percentage of occupied dwelling units using wood for central heating or for cooking dropped from over 20 to less than 10 percent of the total. This decline occurred in farm and rural areas as well as in the cities.

It is likely that consumption of fuelwood in homes will decline still further as a result of such factors as increased use of electricity and bottled gas in rural areas, greater use of modern heating equipment, increased urbanization, and increased per capita income. Under these assumptions it is estimated that consumption of fuelwood in homes may drop from the 36 million cords so used in 1952 to 25 million cords by 1975.

Use of wood for production of steam power in primary wood-using plants is likewise expected to decline somewhat, partly because of increased use of plant residues for fiber products rather than for fuel, and partly because small mills are increasingly turning to internal combustion engines rather than to steam power.

Potential demand for fuelwood in 1975 is estimated at 40 million cords and year-2000 demand at 30 million. Assuming sources in the same proportion as in 1952, about 25 percent would be softwoods and 75 percent hardwoods. Distribution according to sources might be as shown in table 16 above.

LOWER-LEVEL ESTIMATES COMPARED WITH THOSE OF STANFORD RESEARCH INSTITUTE

The estimates of 1952 consumption of timber products and the lower-level estimates of 1975 potential demand developed in this study are similar to a corresponding set of estimates made in 1954 by Stanford Research Institute.[102] This section contains a comparison of the two sets of estimates and a discussion of some of the principal points of difference.

Differences in the Basic Assumption

Several of the differences in the estimates of 1975 demand for timber products stem from differences in the underlying assumptions. The three most important differences in that area are as follows:

	This study	Stanford Research Institute
Gross national product---------billion dollars-------------	630	586
New dwelling units------------------thousand-------------	2,200	1,945
New nonresidential construction expenditures billion dollars-------------	35	25.3

The gross national product projections of this study are at 1953 prices; those by the Institute are at 1952 prices. The Institute's projection is about 7 percent below the figure arrived at in this study. The main difference is that this study assumes man-hour productivity will increase at an average rate of 2.4 percent per year; whereas the Institute's projection implies an average annual rate of increase of 1.42 percent annually. Such a rate would be much below that of the past fifteen years and also well below the long-term 1910-53 average annual rate of increase.

The estimate of demand for new dwelling units in this study is based on a projection of population age 20 and older with allowance for a proportion of unoccupied units slightly greater than existed in 1950. Replacement of obsolete, substandard, and otherwise unusable housing has been projected on the basis of average service life of 70 years. The Institute's projection of demand for new housing is based on "past relationships between new nonfarm housing starts and total population, levels of real disposable income, and trend."[103] The period of observation was apparently 1929-53 which included the Great Depression and World War II, both periods in which the residential construction industry was seriously disrupted.

The projection in this study of expenditures (at 1953 prices) for non-residential construction (not including railroad and farm) is based on the assumption that such expenditures will amount to about the same percent of 1975 gross national product as the average for the past 40 years. The Institute's projection (at 1952 prices) includes railroad construction and farm service buildings. The method of projection is described as "based on past relationships between construction expenditures, population, and gross national product." Apparently, the period of observation was 1929-52. But the Institute's estimate of 1975 expenditures for nonresidential construction is slightly less than the Department of Commerce "outlook" estimate for such expenditures in 1955.[104]

The lower-level estimates of 1975 demand for lumber in this study are based on the assumption of a substantial increase in the real price of lumber relative to real price of competing materials. The amount of such increase has been expressed as a range of from 25 to 30 percent. The Institute's assumption with respect to price of lumber is stated as follows:

> Lumber prices will probably rise more rapidly than the prices of competing materials, but the relative increase is expected to be smaller in the 1952-75 period than it was between 1929 and 1952.

What this means in specific terms is not discussed in the Institute's report. No information on the relationship of lumber prices to the prices of competing materials is presented. It should, perhaps, be recalled that the real price of lumber in terms of the general commodity purchasing power of the dollar increased by approximately 100 percent during the period 1929-52.[105] The real prices of structural steel, cement, and brick increased very little during that period 1929-52. An increase of lumber prices relative to prices of competing materials "somewhat smaller" than in the period 1929-52 might still be 50 to 75 percent.

Differences in the Over-all Estimates

Turning now from the differences in underlying assumptions, the comparison of the two series of estimates of 1952 consumption of timber products and of estimated 1975 demand are shown in table 44. While net imports of lumber, pulpwood, woodpulp, and finished paper are all mentioned in the Institute's report, such imports were not included in its over-all estimates of log and bolt requirements. In order to put the two series of estimates on a comparable basis, it has been necessary to show the Institute's anticipated net imports in terms of log and bolt requirements. The necessary conversions to

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[102] Stanford Research Institute, AMERICA'S DEMAND FOR WOOD, 1929-1975, Weyerhaeuser Timber Company, Tacoma, Washington, 1954.

[103] AMERICA'S DEMAND FOR WOOD, 1929-1975, page 17.

[104] The Institute's estimate of 1975 expenditure for new nonresidential construction is 25.3 billion dollars at 1952 prices (AMERICA'S DEMAND FOR WOOD, table 2, page 16). The Department of Commerce "outlook" estimates for the same types of new nonresidential construction in 1955 amounts to 25.4 billion 1955 dollars (CONSTRUCTION REVIEW, July, 1955, page).

[105] See TIMBER RESOURCE REVIEW, Chapter V, pages 8 - 9.

TABLE 44.--Comparison of estimates of 1952 consumption and 1975 demand by Stanford Research Institute with estimates of 1952 consumption and lower-level 1975 demand estimates of this study

Product class	Standard unit of measure	Estimates in standard units				Estimates in roundwood volume			
		1952 consumption		1975 demand		1952 consumption		1975 demand	
		This study	Stanford Research Institute	This study	Stanford Research Institute	This study	Stanford Research Institute	This study	Stanford Research Institute
		Million	*Million*	*Million*	*Million*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
All lumber consumed	Bd. ft. lbr. tally	--	40,700	48,000	44,600	--	--	--	--
New lumber consumed	do.	41,462	40,200	46,000	43,200	6,419	(6,147)	7,153	(7,185)
Domestic output	do.	39,510	38,400	45,000	41,000	6,146	5,870	6,997	6,820
Decrease of lumber stocks	do.	200	--	--	--	--	--	--	--
Net imports	do.	1,752	1,800	1,000	2,200	273	[1] (277)	156	[1] (365)
Pulpwood and pulpwood equivalent	Cords	35.4	(34.3)	56	(61.4)	2,697	(2,515)	4,150	(3,839)
Domestic output	do.	25.1	(24.5)	42	47.5	1,823	1,760	3,058	2,810
Increase of pulpwood stock	do.	.9	--	--	--	--	--	--	--
Net imports	do.	11.2	(9.8)	14	(13.9)	874	[3] (755)	1,092	[3] (1,029)
Pulpwood	do.	--	2.0	--	1.3	--	--	--	--
Woodpulp	do.	--	3.0	--	6.0	--	--	--	--
Paper and paperboard	do.	--	[2] (4.8)	--	[2] (6.6)	--	--	--	--
Veneer logs and bolts	Bd. ft. log scale	2,467	2,800	4,500	5,400	422	420	773	800
Minor industrial-wood products:									
Cooperage logs and bolts	do.	355	504	400	390	73	70	82	60
Piling	Cubic feet	28	28	27	23	28	30	27	30
Poles	do.	88	103	68	128	88	110	68	140
Hewn ties	Pieces	10.2	15.8	3	13.7	67	100	19	90
Mine timbers, round	Cubic feet	81	100	130	100	81	100	130	100
Other industrial wood	do.	421	340	458	320	362	340	385	320
All industrial wood	do.	([4])	([4])	([4])	([4])	10,237	9,832	12,787	12,564
Fuelwood, from all sources	Cords	58.6	--	40	--	--	--	--	--
From growing stock only	do.	13.1	[5] 17	9.5	[5] 5	965	[5] 1,310	696	[5] 370
All timber products	Cubic feet	([4])	([4])	([4])	([4])	[6] 11,202	11,142	[6] 13,483	12,934
Domestic	do.	([4])	([4])	([4])	([4])	10,055	10,110	12,235	11,540
Net imports	do.	([4])	([4])	([4])	([4])	1,147	1,032	1,248	1,394

Note: In order to make a comparison of the Stanford Research Institute estimates with the estimates of this study, certain computations based on data in AMERICA'S DEMAND FOR WOOD, 1929-1975 have been made. The various estimates derived by such computation are shown in parentheses ( ). The following footnotes indicate what those computations were. Page numbers in the footnotes refer to AMERICA'S DEMAND FOR WOOD, 1929-1975.

[1] The 1952 net import of lumber (1.8 billion board feet, p. 50) at 154 cubic feet per M bd. ft. (p. 80); and 1975 net import (2.2 billion board feet, p. 50) at 166 cu. ft. per M bd. ft. (p. 80).
[2] The 1952 net import of paper, chiefly newsprint (4.6 million tons, p. 54) at 1.05 cords per ton (p. 57); and 1975 net import of 6.3 million tons (p. 54) at 1.05 cords per ton (p. 57).
[3] The 1952 net imports of pulpwood, wood pulp and paper, 9.8 million cords pulpwood and pulpwood equivalent (p. 58 for pulpwood and pulpwood equivalent of woodpulp), at 77 cubic feet per cord (p. 82); and 1975 net imports at 13.9 million cords (p. 58 for pulpwood and pulpwood equivalent of woodpulp) at 74 cu. ft. per cord (p. 82).
[4] Not additive.
[5] "Log and bolt requirements from living commercial timber only" (table 37, following p. 94 and p. 86).
[6] These totals include only that fuelwood cut from growing stock and are therefore different from totals shown elsewhere, which include all fuelwood cut from roundwood, including that from dead and cull trees and from trees on noncommercial forest land.

log and bolt volumes are all based on information contained in the Institute's report. The computations that have been made are explained in footnotes to table 44.

The two series of estimated 1952 consumption of timber products and of estimated 1975 demand by principal items are as follows:

	Units	1952 Consumption		1975 Demand	
		This study	Stanford Research Institute	This study	Stanford Research Institute
New lumber	Billion bd. ft.	41.5	40.2	46.0	43.2
Pulpwood[1]	Million cords	35.4	34.3	56.0	61.4
Veneer logs	Billion bd. ft.	2.5	2.8	4.5	5.4
Minor products	Billion cu. ft.	0.7	0.8	0.7	0.7
All industrial wood	Billion cu. ft.	10.2	9.8	12.8	12.6
Fuelwood[2]	Million cords	13.1	17	9.5	5.0
All timber products	Billion cu. ft.	[3] 11.2	11.1	[3] 13.5	12.9

[1] Including pulpwood equivalent of net imports of woodpulp and paper.

[2] The fuelwood estimate in this study is volume cut from growing stock. That of Stanford Research Institute is fuelwood cut from "living commercial timber."

[3] These totals include only that fuelwood cut from growing stock and are therefore different from totals shown elsewhere, which include all fuelwood cut from roundwood, including that from dead and cull trees and from trees on noncommercial forest land.

The difference in the two estimates of 1952 consumption of all timber products is negligable. With respect to 1975 demand, the estimate by Stanford Research Institute, in terms of roundwood volume of logs and bolts, is 4.1 percent lower than estimated in this study.

With regard to specific product classes, the differences are greater. The Stanford Research Institute estimate of demand for new lumber (board feet lumber tally basis) is 6 percent lower than the estimate of this study, but for pulpwood (cords basis) it is 10 percent higher. The Institute's estimate of 1975 demand for veneer logs and bolts (board feet log scale basis) is 20 percent above the estimate of this study. For the minor industrial-wood products as a whole there is virtually no difference.

The Institute's estimates of fuelwood consumption and demand carry the notation "log and bolt requirements from living commercial timber only." Consumption of such wood in 1952 was estimated at 17 million cords or 1,310 million cubic feet of logs and bolts. The corresponding estimate of 1975 demand was 5 million cords or 370 million cubic feet. The Forest Service estimate that conceptually parallels that of the Institute is the volume of fuelwood cut from forest growing stock. Consumption of such wood in 1952 is estimated in this study at 13.1 million cords or 965 million cubic feet, and 1975 demand at 9.5 million cords or 696 million cubic feet. The Institute's estimate of 1952 consumption is 36 percent higher, but its estimate of 1975 demand is 47 percent below.

Differences in Lumber Estimates

Lumber being the major item in both series of estimates, a further comparison of estimated consumption (1952 for this study and 1953 for the Institute's) and of estimated 1975 demand by major end-uses is shown in Table 45. That comparison is rather difficult because of differences in end-use classification. Certain adjustments in classification have been made to facilitate comparison of the two series of estimates, but there is

TABLE 45.--Estimates of 1952 lumber consumption by end-use and lower-level estimates of 1975 demand according to this study; estimates of 1953 consumption and of 1975 demand according to Stanford Research Institute

End use	Estimates of consumption		Estimates of 1975 demand	
	1952--this study	1953--Stanford Research Institute	This study	Stanford Research Institute
	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*
New residential construction	12,700	12,482	16,500	16,917
Alterations and additions to residential structures	(1)	1,100	(1)	1,100
Nonhousekeeping units--hotels, motels, etc.	(2)	278	(2)	274
Total new residential	---	13,860	--	18,291
New nonresidential, excluding railroad and farm	6,000	[3] 7,213	7,000	[3] 4,675
Residential maintenance, repair, and alterations	3,900	--	4,200	--
Nonresidential maintenance and repair, excluding railroad and farm	1,900	--	2,300	--
All maintenance and repair, excluding railroad and farm	5,800	[4] 6,800	6,500	[4] 7,200
Railroad construction, new and maintenance:				
Sawed crossties and bridge ties	1,207	[5] 800	1,460	[5] 713
Lumber for new freight cars	100	224	85	95
Other lumber used by railroads	605	--	500	--
Total lumber used by railroads	1,912	--	2,045	--
Farm service buildings:				
New construction	--	[6] 977	--	[6] 400
New construction and maintenance	3,000	--	2,500	--
Lumber used in mining:				
Sawed mine timbers	--	[7] 250	--	[7] 337
All lumber used in mining	900	--	1,000	--
All construction, including maintenance and repair	30,312	[8] 30,124	35,545	[8] 31,711
Lumber for manufactured products:				
Furniture and fixtures	2,196	2,224	3,550	3,864
Other products	2,004	2,552	2,550	1,741
All lumber used in manufactured products	4,200	[9] 4,776	6,100	[9] 5,605
Lumber used in shipping:				
Boxes and crates, nailed and wirebound	4,989	4,350	4,000	5,350
Pallets	825	900	1,400	1,200
Dunnage	1,000	1,400	1,000	750
Other	100	(10)	100	(10)
All lumber used in shipping	6,914	6,650	6,500	7,300
Total lumber used or demand:	(11)	[12] 41,300	[13] 48,000	[12] 44,650
Re-used lumber	(11)	500	2,000	1,400
New lumber use or demand	[13] 41,462	40,800	46,000	43,250

[1] Included in residential maintenance and repair.
[2] Included in new nonresidential construction.
[3] Lumber for new construction by railroads (other than sawed crossties and for new freight cars) included here with "utilities." New farm service buildings shown below.
[4] Presumably includes maintenance and repair of railroads and of farm service buildings.
[5] This figure based on estimated consumption of 19.8 million hewn ties in 1952, and demand for 13.7 million hewn ties by 1975.
[6] This estimate, presumably, is for new farm service buildings only.
[7] Obtained by subtracting estimate of sawed railroad ties from estimate of "Sawn railroad ties and mine timbers." No other estimate of lumber used in mining was given.
[8] These figures differ from those shown in AMERICA'S DEMAND FOR WOOD, 1929-1975, table 12, p. 50, on account of the shifting of lumber for new freight cars from the "manufactured products" class to railroad construction above. The further difference is due to rounding.
[9] Lumber for new freight cars shown separately above. Total for manufactured products adjusted accordingly.
[10] No estimate given for these items.
[11] Not estimated.
[12] Items do not quite add to this total, presumably because of rounding.
[13] Items do not quite add to this total on account of rounding.

a limit to the amount of re-classification that can be done and still not be unfair either to one study or the other. The many footnotes to table 45 indicate the difficulties.

The estimated 1975 demand for new lumber, according to the analysis presented in this study, amounts to 46.0 billion board feet. The Institute's estimate is 43.3 billion. Because re-used lumber was not distributed by end-use in either study, further comparison of demand by end-uses must be made on the basis of estimated demand for both new and used lumber.

The task of spotting the principal differences in the two sets of 1975 demand estimates can best be done by first considering the end-use classifications that are most nearly comparable--(1) new residential construction, (2) lumber used in manufactures, and (3) lumber for use in shipping. The comparison of estimated demand for lumber in these three categories of use is as follows: (The figures are in million bd. ft.)

	This study	Stanford Research Institute
New residential[1]	16,500	16,917
Manufactures[2]	6,100	5,605
Shipping	6,500	7,300
Total	29,100	29,822

[1] Excluding alterations and additions to residential structures and nonhousekeeping facilities, like hotels and motels.
[2] Not including lumber for new freight cars.

With respect to estimated 1975 demand for these three major end-uses, the Institute's estimate is 2.5 percent higher than the estimate arrived at in this study--the difference is not significant.

Comparison of the two sets of estimates for the other end-uses is difficult and complicated because of differences in classification. About all that can be said, without getting enmeshed in details, is that the Institute's 1975 projection of nonresidential construction is lower than in this study as are the estimated requirements of railroads, of farms, and of the mining industry (table 45).

THE UPPER-LEVEL ESTIMATES OF POTENTIAL DEMAND FOR TIMBER

The estimates of potential demand, so far presented in this chapter, have been developed on a product-by-product basis. Past consumption trends have been analyzed for indications of what the future demand for each product might be. The price assumptions in the lower-level estimates have also been based on past trends--a decided upward movement of lumber price and comparative stability in price of pulpwood products. The estimates of potential demand for veneer logs and bolts imply that consumption of plywood and veneer will not increase as rapidly as it has during the past 20 years. That would also allow for some increase in price.

The lower-level estimates make allowance for a rather large displacement of lumber by other materials. It is assumed, for example, that the average lumber content per new dwelling unit constructed will decrease by 25 percent between 1952 and 1975, and that lumber-use per dollar of expenditure for new nonresidential construction will decrease by 30 percent. Other decreases in lumber-use per unit of product manufactured, or per dollar of expenditure, have been assumed for practically all end-uses. The total market-loss[106] in use of lumber, implicit in the lower-level estimates of potential demand, exceeds 12 billion board feet by 1975 and 24 billion by 2000. The end-uses in which the market-losses can be expressed quantitatively are as follows:

	Market-loss in Lumber-use (billion bd. ft.)	
	1975	2000
New residential construction	5.5	7.2
Residential maintenance and additions	1.2	1.7
Total residential	6.7	8.9
Nonresidential construction	3.2	9.4
Nonresidential maintenance	.9	3.0
Total nonresidential	4.1	12.4
Furniture	.3	1.1
Other manufactured products	.6	1.6
Total manufactured products	.9	2.7
Total market-loss in these uses	11.7	24.0

The totals shown above do not include a heavy market-loss by lumber in the shipping-container field. Other smaller areas of market-loss would be: In use by railroads, in nonresidential use on farms, and in use by the mining industry.

Part of the lumber market-loss involved in the lower-level estimates of potential demand is off-set by expected increases in use of paper and paperboard products, of wood-fiber boards, and of plywood and veneer.

The pertinent question is whether or not the anticipated increases in use of timber products other than lumber would fully compensate for the market-loss suffered by lumber.

[106] The difference between the lower-level estimates of potential lumber demand and the estimates obtainable by holding average lumber content per new dwelling unit or per dollar of expenditure as it was in 1952.

The often-expressed idea that wood is a versatile material was never more valid than at present. There is little evidence to indicate that its field of economic usefulness is technologically more restricted than the fields of iron, aluminum, clay, cement, agricultural fibers, or any of the physical-structure materials used in the production of the things required by a modern economic system.

Looking ahead twenty-five to fifty years, there are real probabilities that the use of wood (as wood and in mechanically and chemically modified forms of wood and wood fractions) for industrial raw material is still in its youthful stage of development. One indication that utilization of wood may be in the early phase of a new era can be seen in the statistics comparing trends in consumption of industrial wood with consumption of all physical-structure materials. After a long period in which intake of wood continually fell behind intake of other material, there came a time when that relationship changed. Since the 1930's, the intake of industrial wood has almost kept pace with intake of other physical-structure material.[107]

On the basis of the record of the past fifteen years, and in the light of the new technological developments in wood uses,[108] it is not unreasonable to expect that demand for industrial wood might continue--for the next fifty years at least--to parallel the expanding intake of all physical-structure material. The expectation is valid, however, only on the assumption that the real price of industrial wood in general does not increase any faster than real price of its competing materials.[109]

Projected Increase of Physical-Structure Material Intake

Per capita annual consumption of all physical-structure material (including industrial wood) increased during the first half of this century at the average annual rate of approximately 0.53 percent compounded. If that rate of increase continues for fifty years longer, per capita consumption of physical-structure material will go up from the 1948-51[110] level of 34.73 constant-dollar quantity units[111] to 39.42 by 1975 and to 44.28 by 2000. A 1975 population of 210 million would be consuming 8,280 million constant-dollar quantity units, and a year-2000 population of 275 million would be consuming

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[107] See Chapter V, pages 40 and 41.

[108] See Chapter V, pages 29 to 41.

[109] There are, of course, some physical-structure materials and many physical-structure-material uses that are not in competition with industrial wood in any form. It would, no doubt, have been better to have excluded all such materials and material uses from the forthcoming analyses, but the available statistics of materials consumption do not permit that kind of refinement.

But even if such statistical refinement were practicable, it would not be conclusive. Modern technology that can transform forest trees into women's dresses just as cheaply as it can transform raw cotton into women's dresses, is continually expanding the area in which the basic physical-structure materials compete with each other. Presumably, wood will never be used for razor blades, but wood impregnated with synthetic resin and pressed to high density may soon be competing with metals in uses for which it has never been suitable before.

[110] Because per capita average consumption fluctuates somewhat from year to year, a 4-year period has been used as a base rather than one particular year. The year 1952 appears to have been normal with regard to consumption of industrial wood, but quite abnormal with respect to consumption of other physical-structure material. This was probably due to the rearmament program launched after outbreak of the Korean War. The base period used for projection of demand for physical-structure material as a whole does not include 1952 because of that apparent abnormality. The decision to exclude 1952 from the projection base makes the estimate of 1975 and 2000 intake somewhat lower than it would have been had 1952 been included.

[111] For explanation of the term "constant-dollar quantity unit," the reader should refer back to footnote 40, page 40 of this chapter.

12,175 million units. The percentage increase during the period 1950-75 would be 60 percent and during the period 1950-2000 it would be 135 percent.

Shifting the base for measurement from 1950 to 1952 to correspond with the series of timber-demand estimates of this study, the increase of physical-structure material consumption during the 1952-75 period becomes 39.6 percent and during the period 1952-2000 it becomes 105.2 percent (table 46).

TABLE 46.--Per capita and total consumption of physical-structure material in the United States 1950 and 1952; projections to 1975 and 2000

Year	Per capita	Total	Index	Index
	Constant-dollar quantity units	*Million constant-dollar quantity units*	*1952 equals 100*	*1952 equals 100*
1950	[1] 34.73	[2] 5,174	100	87
1952	37.79	[2] 5,933	115	100
1975	[3] 39.42	8,280	160	139.6
2000	[3] 44.28	12,175	235	205.2

[1] Actually the 1948-51 average used as a base for per capita projections.
[2] U. S. Bureau of the Census, RAW MATERIALS IN THE UNITED STATES ECONOMY 1900-1952, page 60.
[3] Projected from the 1948-51 base (taken as 1950) at the long-term average annual rate of increase--0.53 percent compounded. Rate of increase computed from data in RAW MATERIALS IN THE UNITED STATES ECONOMY, 1900-1952.

INDICATED DEMAND FOR INDUSTRIAL WOOD AND FOR ALL TIMBER PRODUCTS

Assuming that real price of industrial wood as a whole, and real price of competing materials would remain at approximately their 1952 relationship, there is a probability that the consumption of industrial wood might increase at about the same rate as intake of all physical-structure material. It came rather close to doing just that between 1945 and 1952 in spite of the 34 percent increase in the real price of lumber (table 47).[112]

The projections that presumably would maintain industrial wood at its 1952 position (quantity-wise) in the Nation's intake of all physical structure material indicate potential demand for 14,289 million (roundwood) cubic feet by 1975 and 21,009 million by the year 2000. That would be an increase of 39.6 percent during the period 1952-75 and an increase of 105.2 percent during the period 1952-2000.

There is no evidence whatever that demand for fuelwood will expand at a rate similar to the increased intake of all energy materials. In fact, the trend of fuelwood demand is most likely to be downward. For this reason the fuelwood component of the upper-level estimates of demand for all timber products is the same as in the lower-level estimates.

[112] Changes in the real price of lumber over the period 1900-54 are discussed in Chapter V, pages 6-9.

TABLE 47.--Consumption of industrial wood and of all physical-structure material 1930-52; projections to 1975 and 2000

Year	Industrial wood[1]	All physical-structure material[2]	Relationship[3]
	Million cu. ft.	*Million constant-dollar quantity units*	*cubic feet per unit*
1930	6,754	2,967	2.3
1931	5,131	2,883	1.8
1932	3,853	2,054	1.9
1933	4,566	2,131	2.1
1934	4,901	1,834	2.7
1935	5,920	2,619	2.3
1936	6,540	2,900	2.3
1937	6,835	3,985	1.7
1938	6,124	3,037	2.0
1939	7,087	3,490	2.0
1940	8,007	4,026	2.0
1941	8,477	4,908	1.7
1942	9,790	4,993	2.0
1943	8,816	4,460	2.0
1944	8,257	4,706	1.8
1945	7,754	4,173	1.9
1946	8,443	4,379	1.9
1947	8,770	4,592	1.9
1948	9,360	5,506	1.7
1949	8,796	4,944	1.8
1950	10,137	5,174	2.0
1951	10,116	5,276	1.9
1952	10,237	5,933	1.7
		Projections	
1975	14,289	8,280	1.7
2000	21,009	12,175	1.7

[1] Forest Service estimates of apparent consumption including roundwood equivalent of net imports of lumber, pulpwood, woodpulp and finished paper.
[2] U. S. Bureau of the Census, RAW MATERIALS IN THE UNITED STATES ECONOMY 1900-1952, page 81.
[3] Column 2 divided by column 3.

The upper-level estimates of potential demand for all timber products in terms of roundwood volume are as follows:

	Industrial wood		Fuelwood		All products	
	Million cu. ft.	Index	Million cu. ft.	Index	Million cu. ft.	Index
1952 Consumption----------	10,237	100	2,008	100	12,245	100
1975 Demand --------------	14,289	140	1,504	75	15,793	129
2000 Demand --------------	21,009	205	986	49	21,995	180

Allowing for the expected decline of demand for fuelwood in roundwood form, the upper-level estimates indicate a 29 percent increase in demand for wood in the period 1952-75 and an increase of 80 percent in the period 1952-2000.

Assuming that these estimated demands could be met, the changes in per capita consumption of timber would be as follows:

	Industrial wood		Fuelwood		All products	
	Cu. ft.	Index	Cu. ft.	Index	Cu. ft.	Index
1952 Consumption	65	100	13	100	78	100
1975 Demand	68	105	7	54	75	96
2000 Demand	76	117	4	31	80	103

The estimates allow for a 5 percent increase in per capita consumption of industrial wood in the period 1952-75 and a 17 percent increase in the period 1952-2000. That future personal income will be entirely adequate to take that much wood off the market is relatively certain. The gross national product projections developed earlier in this chapter indicate the probability that real disposable personal income will increase by 30 percent in the period 1953-75 and by 90 percent in the period 1953-2000. [113]

It should be noted that the increase in per capita consumption of industrial wood allowed for in these upper-level estimates of potential demand is more than offset by the expected decrease in per capita consumption of fuelwood. Insofar as all timber products are concerned, the estimates would involve a 4 percent decrease of per capita consumption in the period 1952-75 and a 3 percent increase in the period 1952-2000. [114]

The previous summary of the lower-level estimates of potential demand for timber products contains a discussion of those estimates in terms of their relationship to the anticipated increases in the intake of physical-structure material and of energy material. These upper-level estimates have been made high enough to keep industrial wood in its 1952 relationship with respect to the nation's total intake of physical-structure material. [115]

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[113] See table 1 and page 14 of this chapter.

[114] This last figure, indicating a reversal of trend after 1975, is contingent on the comparatively slower rate of population increase assumed for the period 1975-2000 in the population projections used in this study. If birth rates should not decline as assumed in the population projection but continue only slightly below the rates that have prevailed since the early 1940's, year-2000 population will be somewhere between 300 and 320 million. In that case the upper-level estimate of 2000 demand for all timber products would not be sufficient to maintain per capita consumption at the 1975 level.

[115] The validity of this statement is, of course, contingent on the projection of the nation's total requirement for physical-structure material. It is believed that the projection offered in this study is as conservative as can reasonably be made. See previous discussion of this matter, pages 15-17.

The upper- and lower-level estimates of potential demand for industrial wood in terms of a relative-consumption index (1952 = 100) are now put side by side:

	Relative-consumption index	
	Upper-level estimate	Lower-level estimate
1952	100	100
1975	100	89
2000	100	81

The upper-level estimate indicates what future demand would be if industrial wood as a whole should retain its 1952 position in the nation's intake of physical-structure material. The lower-level estimate implies a 11-percent loss in position during the period 1952-75 and a 19-percent loss in the period 1952-2000.

UPPER-LEVEL ESTIMATES IN TERMS OF DEMAND ON DOMESTIC FORESTS

The upper-level estimates, so far discussed, include the anticipated net imports of lumber, pulpwood, veneer logs, woodpulp, and paper.[116] Deducting such net imports from the upper-level estimates of demand for all timber products, the indicated demand on domestic forests in terms of roundwood would be as follows:

	All species		Softwood		Hardwood	
	Million cu. ft.	Index	Million cu. ft.	Index	Million cu. ft.	Index
1952 consumption	11,098	100	7,522	100	3,576	100
1975 Demand	14,545	131	9,928	132	4,617	129
2000 Demand	20,652	186	14,028	186	6,624	185

These figures, of course, contain a substantial fuelwood component drawn in part from dead and cull trees.

The estimated demand on domestic forests for industrial wood, in terms of log and bolt volume, might be as follows:

	All species		Softwood		Hardwood	
	Million cu. ft.	Index	Million cu. ft.	Index	Million cu. ft.	Index
1952 Consumption	9,090	100	7,046	100	2,044	100
1975 Demand	13,041	143	9,650	137	3,391	166
2000 Demand	19,666	216	13,766	195	5,900	289

The softwood-hardwood allocation shown here is based in the relationship indicated by the product-by-product analysis of potential demand.

[116] Discussed above.

Demand in Terms of Timber Cut

In translating the upper-level estimates of demand on domestic forests from roundwood basis to equivalent cut of growing stock and sawtimber, allowance has been made for improved utilization in both woods and mills.[117] The indicated cut would be as follows:

		Growing stock (million cu. ft.)		Live sawtimber (million bd. ft.)	
		Industrial wood	All products	Industrial wood	All products
1952 Cut	All species	9,753	10,757	46,594	48,840
	Softwood	7,244	7,487	35,951	36,546
	Hardwood	2,509	3,270	10,643	12,294
1975 Demand	All species	13,298	13,994	63,795	65,430
	Softwood	9,413	9,557	47,277	47,620
	Hardwood	3,885	4,437	16,518	17,810
2000 Demand	All species	19,265	19,713	94,003	95,080
	Softwood	12,849	12,985	68,087	68,410
	Hardwood	6,416	6,728	25,916	26,670

[117] There is a more detailed discussion of this matter in the opening section of Chapter VII.

COMPARISON OF THE TWO SETS OF POTENTIAL-DEMAND ESTIMATES

A summary comparison of the lower-level and the upper-level estimates of potential demand for timber products is shown in table 48 and figure 10.

With respect to all timber products (roundwood basis including fuelwood), the two sets of potential-demand estimates in terms of percentage increase over 1952 consumption are as follows:

	Percentage increase	
	1952-75	1952-2000
Lower-level estimate	17	47
Upper-level estimate	29	80

Because so much of the fuelwood cut comes from sources other than forest growing stock, the "all timber products" figures are less significant than the "industrial wood" figures.

The two sets of estimates in terms of percentage increase over 1952 industrial-wood consumption are as follows:

	Percentage increase	
	1952-75	1952-2000
Lower-level estimate	25	67
Upper-level estimate	40	105

While some increase in net import of timber products is anticipated, that increase (percentagewise) is not quite as much as the estimated increase of demand. The two sets of estimates in terms of percentage increase of demand on domestic forests are as follows:

TABLE 48.--Comparison of the lower-level and the upper-level estimates of potential demand for timber products 1975 and 2000

Product class		1952 Consumption	1975 Potential demand		2000 Potential demand	
			Lower-level estimate	Upper-level estimate	Lower-level estimate	Upper-level estimate
All timber products (roundwood)	Million cu. ft.	12,245	14,291	15,793	18,035	21,995
	Index	100	117	129	147	180
All industrial wood (roundwood)	Million cu. ft.	10,237	12,787	14,289	17,049	21,009
	Index	100	125	140	167	205
Demand on domestic forests (roundwood)	Million cu. ft.	11,098	13,043	14,545	16,692	20,652
	Index	100	118	131	150	186
Demand on domestic forests (timber cut):						
Growing stock	Million cu. ft.	10,757	12,427	13,994	15,657	19,713
	Index	100	116	130	146	183
Live sawtimber	Million bd. ft.	48,840	55,990	65,430	69,008	95,080
	Index	100	115	134	141	195

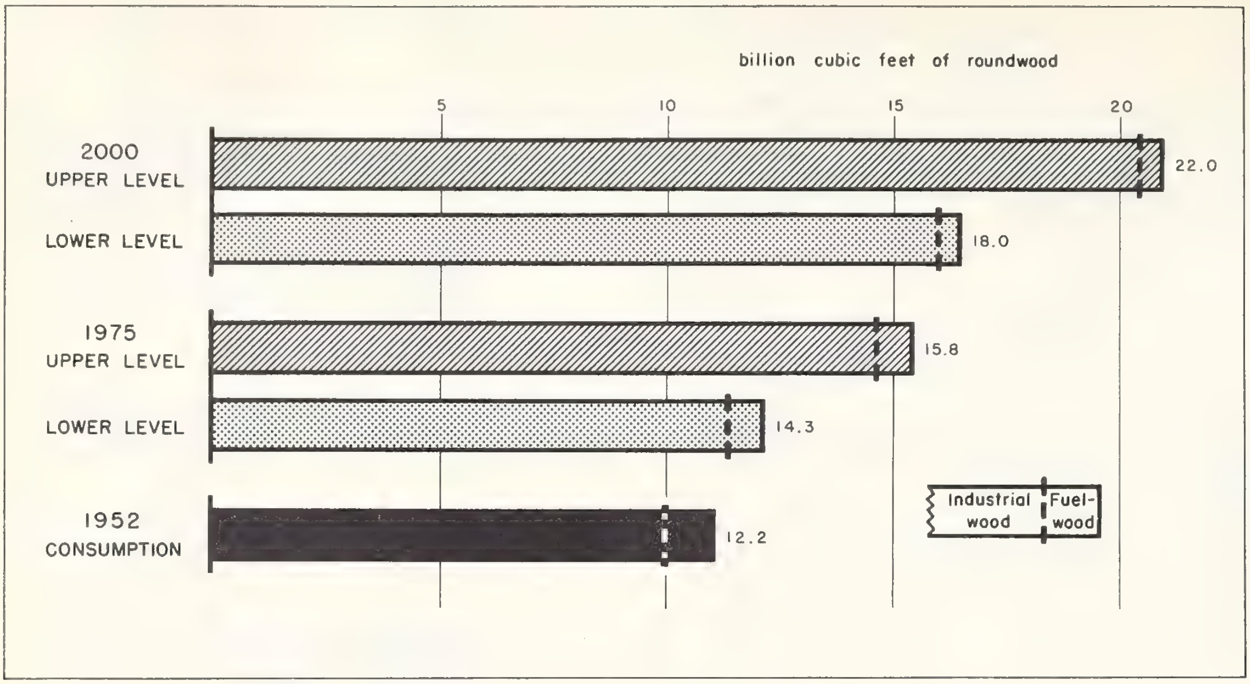

Figure 10 — Estimates of potential demand compared with 1952 consumption.

	Percentage increase 1952-75	1952-2000
Lower-level estimate-------------	18	50
Upper-level estimate -------------	31	86

Translating the estimated demand upon domestic forests into timber cut, with appropriate allowance for improved utilization, the two sets of estimates in terms of percentage increase over 1952 cut are as follows:

	Percentage increase 1952-75	1952-2000
Growing stock:		
Lower-level estimate-----------	16	46
Upper-level estimate -----------	30	83
Live Sawtimber:		
Lower-level estimate-----------	15	41
Upper-level estimate -----------	34	95

Several times in this chapter it has been emphasized that estimates of potential demand are not intended to be forecasts of future consumption. Their chief purpose is to provide a framework for analysis of future timber-supply possibilities. The lower-level estimates indicate the volume of timber products that would probably be taken off the market annually by 1975 and by 2000 by prices substantially higher in relation to competing materials than prevailed in 1952. Use of timber products would, however, be much more restricted than in 1952. The upper-level estimates indicate the volume that would probably be taken at target dates should price relationships remain about as they were in 1952. Use of timber products throughout the economy would be no more restricted than it was in 1952. There would be no appreciable net substitution of other materials for timber nor of timber products for other materials.

With this framework of lower and upper demand possibilities established, attention now turns to analysis of the domestic timber-supply possibilities of the future.

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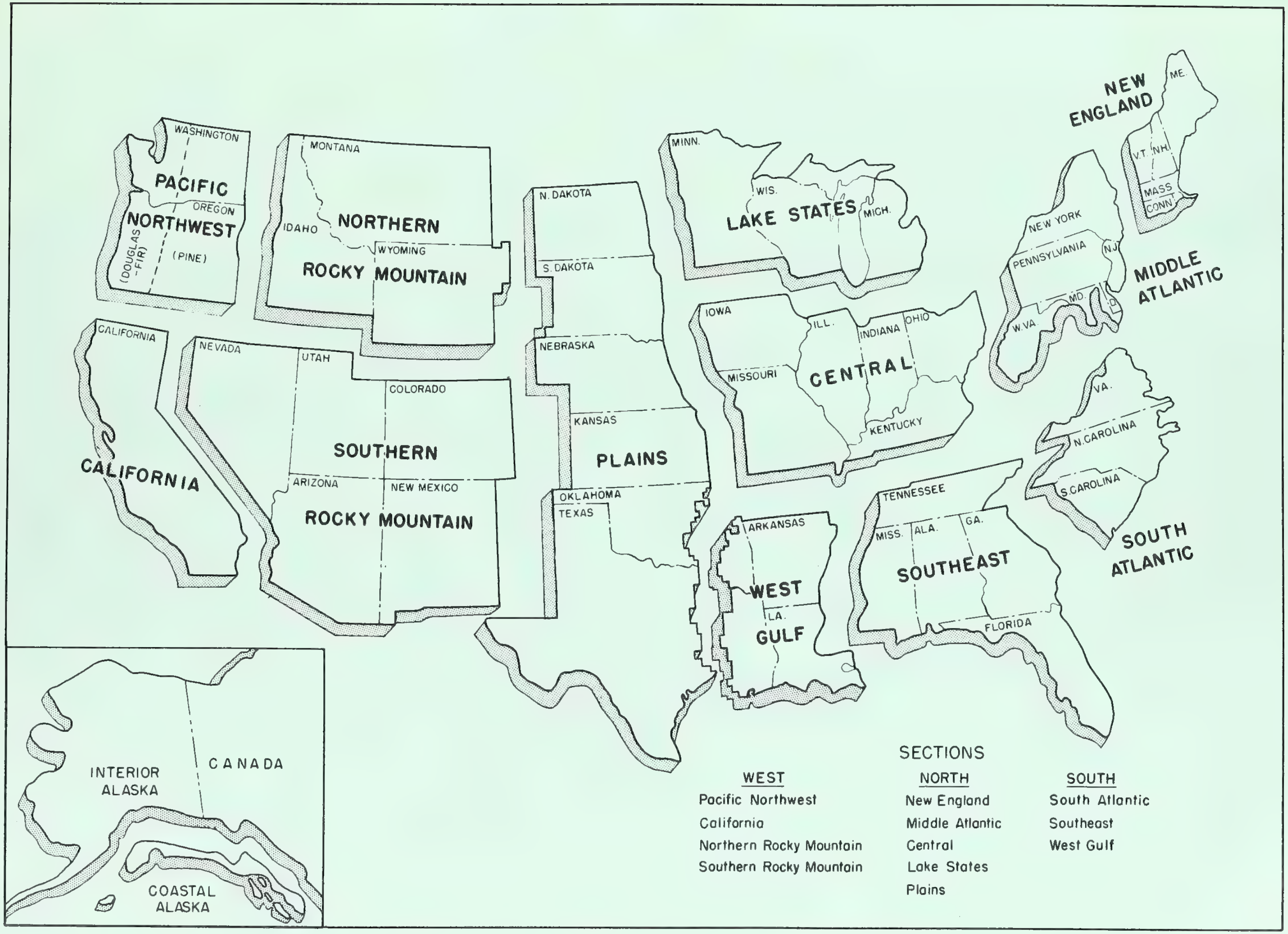


Regions and Sections used in the Timber Resource Review

TIMBER RESOURCE REVIEW

CHAPTER VII
FUTURE SUPPLY AND QUALITY OF DOMESTIC TIMBER

(Preliminary Review Draft Subject To Revision)

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INDEX TO TIMBER RESOURCE REVIEW REPORTS AND APPENDIX MATERIAL

(Each Chapter and each Section, in the case of Chapters IV and IX, is a separate document)

CHAPTER VII. F U T U R E S U P P L Y A N D Q U A L I T Y O F D O M E S T I C T I M B E R

(Preliminary review draft subject to revision)

By:

C. Edward Behre
S. Blair Hutchison

September, 1955

Contents

CHAPTER VII. FUTURE SUPPLY AND QUALITY OF DOMESTIC TIMBER

INTRODUCTION

Preceding chapters have given the facts as to our present forest resources. The area and geographic distribution of the forest land; the volume of standing timber and its character and distribution; the rate of timber growth, mortality, and cut; these have all been set forth. The opportunity for better utilization has been considered. The condition of recently cutover lands has been reported. The status of ownership, protection, and forest planting have been analyzed. Price and other factors affecting consumption of timber products have been discussed. In addition, estimates of future requirements for timber products in 1975 and 2000 have been made on two bases.

It remains for this chapter to explore the effects of cutting to meet future requirements with a margin for contingencies upon net growth and timber inventory. As a starting point, an estimate is made of long-range realizable annual growth. Estimates are also made of net growth needed to satisfy estimated requirements in 1975 and 2000 with a margin for contingencies. The impacts of patterns of use rising to the indicated figures of cut plus margin for 1975 and 2000 upon timber inventory and net growth during the period 1952 to 2000 are then analyzed in a framework of anticipated trends in forest protection and management. Finally certain aspects of the timber situation and outlook are interpreted in the light of these analyses.

CRITERIA FOR GAUGING FUTURE TIMBER SUPPLY AND QUALITY

REALIZABLE GROWTH

What is the timber growing capacity of the Nation's commercial forest lands? This is an important question in gauging the feasibility of meeting future timber requirements. An answer depends upon how timber growing capacity is defined.

Growth studies on small plots in many parts of the country indicate that the biological potential of our forest lands, if fully developed, would be several times any growth yet achieved on a regionwide basis. Although no comprehensive estimates of biological potential have been made, it might total as much as 50 billion cubic feet, including perhaps 200 billion board feet of sawtimber. Whatever the biological potential may be, it cannot be fully realized with present limited knowledge of tree growth and forest management practices or under foreseeable economic conditions. The biological potential may be viewed as a great untapped resource available when and to the extent that the advance of technical knowledge permits and economic circumstances justify its development.

A concept related insofar as possible to the specific set of assumptions outlined in Chapter VI is more useful and has been adopted for this analysis. It is appropriate to refer to such a concept as "realizable growth" rather than growth capacity.

Realizable growth as used in this report represents the growth attainable in the long-range future if there were applied to all commercial forest land the intensity of forestry justified under the national economy assumed for the future.

Using this broad definition, specialists in each region estimated realizable growth supplementing available and pertinent forest management data with their best judgment of over-all conditions. In some cases, however, their calculations represented the application to all lands in a region of the growth rates per acre being achieved at present on the best managed properties in each forest type, and therefore may be conservative.

Summing up such regional estimates, it appears that realizable growth for the United States and Coastal Alaska is approximately 100.7 billion board feet of sawtimber or 27.5 billion cubic feet of total growing stock (table 1).

Seventy percent of the realizable growth is in the East. However, realizable growth per acre of commercial forest land in the West and in Coastal Alaska averages a little higher than in the South and considerably higher than in the North (fig. 1).

It will come as a surprise to some that the realizable growth per acre averages less in the South than in the West and Coastal Alaska. The high rate for Alaska is due to the prevalence of the Sitka-spruce-hemlock type there--a type exhibiting a greater growth potential than any other. The highest regional rate of realizable growth is in the Douglas-fir subregion where it averages 585 board feet per acre--more than twice the average rate in Coastal Alaska or any other region. This high rate coupled with relatively favorable rates in California balances with the lower rates of other western regions to place the rate for the West as a whole somewhat above that for the South, although not quite up to that of Coastal Alaska.

The low average rate for sawtimber in the North is due to the prevalence of such types as aspen, jack pine, and black spruce which sometimes mature before reaching sawtimber size, as well as to generally less favorable growing conditions.

Realizable Growth Is Double Present Growth

Table 2 shows that the country's realizable growth is double the present growth. The disparity is greater for softwoods than for hardwoods. Present growth of softwoods is about 40 percent of realizable growth, whereas for hardwoods it is about 65 percent. Since there is more demand for softwoods than hardwoods, this accentuates the need and opportunity to increase softwood growth. Actually the tendency in some eastern forest types is for the proportion of hardwoods to increase while the proportion of softwoods declines.

Table 1.--Realizable timber growth, United States and Coastal Alaska

Class of material and section	Total	Softwoods	Hardwoods	All species per acre
	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.	Bd. ft.
Sawtimber:				
North	24.7	4.2	20.5	142
South	45.4	35.4	10.0	235
West and Coastal Alaska	30.6	30.1	.5	252
Total or average	100.7	69.7	31.0	206
	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.	Cu. ft.
Growing stock:				
North	9.1	1.8	7.3	52
South	10.8	7.9	2.9	56
West and Coastal Alaska	7.6	7.3	.3	62
Total or average	27.5	17.0	10.5	56

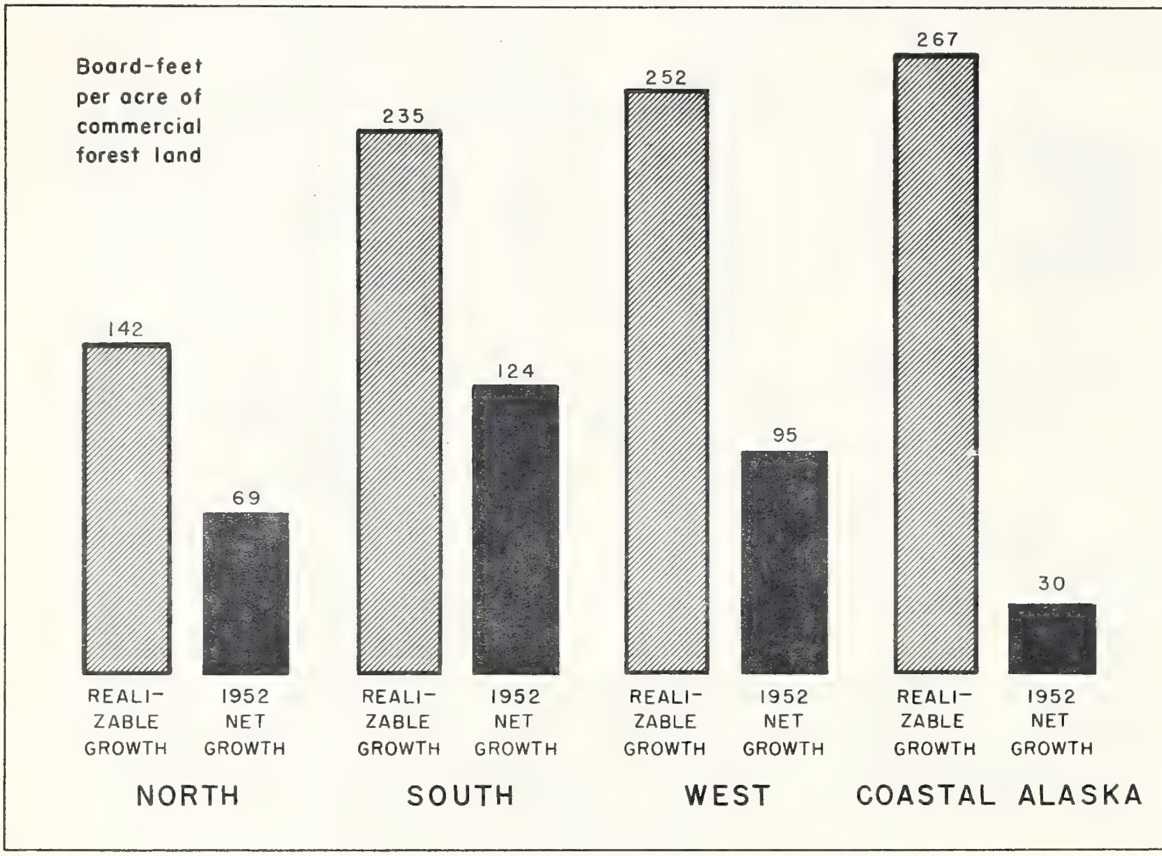


Fig. 1 — Comparison of realizable growth and 1952 net growth per acre.

Table 2.--Realizable growth and current growth, United States and Coastal Alaska

Species group	Sawtimber		Growing stock	
	Realizable growth	1952 growth	Realizable growth	1952 growth
	Billion bd. ft.	Billion bd. ft.	Billion cu. ft.	Billion cu. ft.
Softwoods	69.7	28.0	17.0	7.0
Hardwoods	31.0	19.4	10.5	7.2
Total	100.7	47.4	27.5	14.2

Realizable growth represents a real challenge to forestry in all parts of the country (fig. 1). In Coastal Alaska, where virgin forests predominate, current growth is only a small fraction of estimated capacity. Largely because of the influence of old-growth stands, timber growth constitutes a substantially smaller percentage of realizable growth in the West than in either North or South. Nevertheless, for the same reason and because of the preponderance of public and large private ownership, it may be easier to bring actual growth up toward realizable growth in the West than in the East.

Distribution of Realizable Growth Indicates Eventual Shift of Output from West to East

A comparison of realizable growth and 1952 timber cut by sections (fig. 2) shows that the current distribution of the timber industries is not related to timber growing capacity. The West, which is supplying 46 percent of the timber cut, has only 29 percent of the realizable growth. On the other hand, the South, which is producing 40 percent of the timber cut has 45 percent of the realizable growth. The North contributes only 14 percent of the timber cut, but has 25 percent of the realizable growth.

This disproportionate distribution of timber cut is related primarily to the availability of timber of large size and good quality. In the West, with its large backlog of virgin timber, cut in 1952 was about three-fourths of the realizable growth. It may come even closer to realizable growth or exceed it for a time as the remaining virgin areas are opened for operation. This is so because virgin areas usually have more growing stock than is needed for optimum production with a balanced distribution of age-classes and management plans for such areas usually call for a liquidation of the excess growing stock by cutting in excess of sustained yield capacity for a number of years.

In the East, still suffering from a long history of heavy exploitation and uncontrolled fire, the timber cut is far below realizable growth. Eastern softwood cut will need to remain well below realizable growth for several decades if softwood growing stock is to be built up to a level which will sustain a larger output. Eastern hardwood cut will also remain low--as much from inadequate demand as from the need to rebuild depleted growing stocks. Nevertheless, in the long run, output by regions will tend to become adjusted more closely to realizable growth than is the case today. This will mean a reversal of recent trends and a shift of a larger proportion of timber cut from West to East.

NEEDED TIMBER GROWTH

In general, the Nation's forest policy should aim to meet needs of the present and assure coming generations of an adequate supply of wood. Failure to anticipate fully the needs of the future will cramp the economy of that time. For this reason, the volume of annual growth which it seems prudent to develop should be sufficient to provide not only the cut needed to meet future requirements, as estimated in the preceding chapter, but also a margin for contingencies not covered by

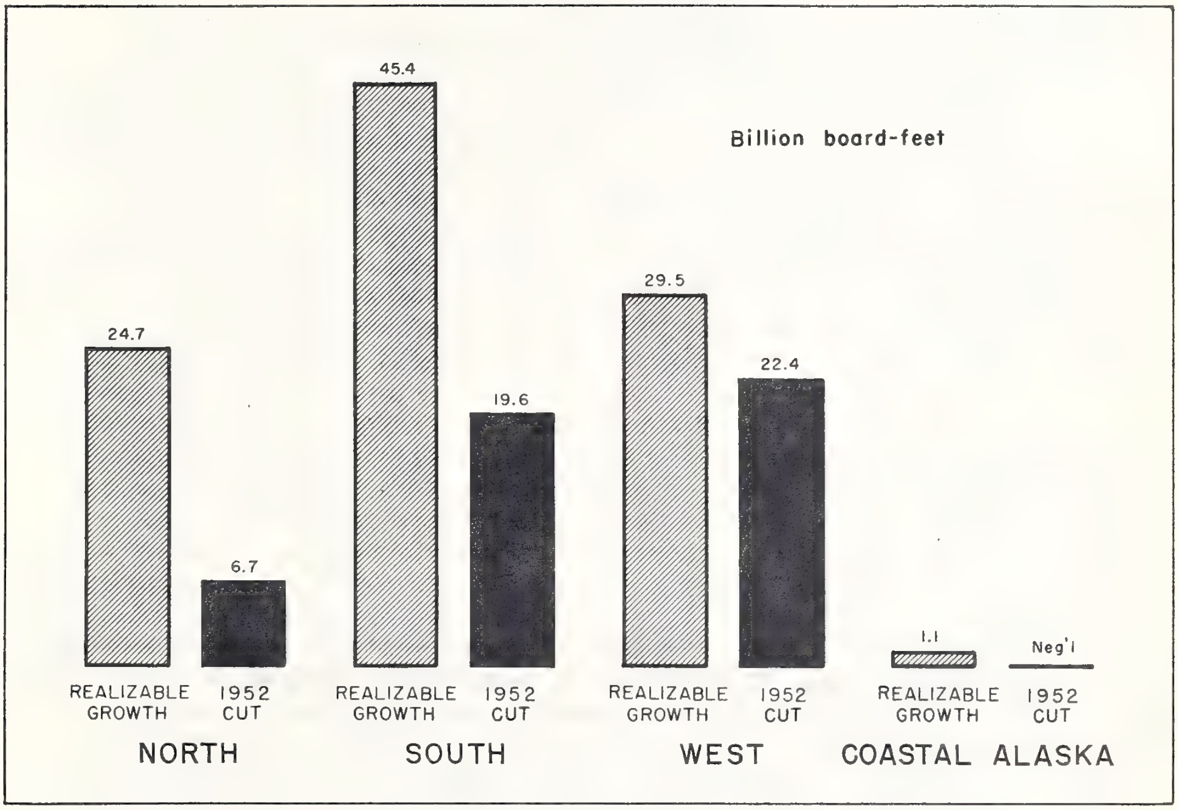


Fig. 2 - Comparison of realizable growth and 1952 timber cut.

the requirements estimates. Consideration will be given first to the extent to which progress in utilization may influence the volume of timber cut needed to meet future requirements in 1975 and 2000 and then to the margin which must be added to establish the total volume of needed growth.

Progress in Utilization

The amount of timber cut from growing stock to meet a given timber product requirement depends on the volume of product imports, on the volume of product obtained from plant residues, on the volume obtained from dead and cull trees and trees on noncommercial forest and nonforest lands, on the volume of growing stock knocked down or otherwise killed in logging and not used, on the closeness to which the timber cut is used, and on the efficiency of manufacture in the mills. The volume of imports in 1975 and 2000 has been considered in the preceding chapter in arriving at the estimates of domestic requirements for the major products. All the other factors mentioned above are related to economic conditions and technological progress in the forest industries.

The forest industries have made substantial progress in using progressively less desirable timber and making more complete use of the trees cut. These trends of utilization were discussed in Chapter III (pages 67 to 71). However, the opportunities to increase timber products output without a commensurate increase in timber cut have not been exhausted. There are, of course, adverse factors which operate in the other direction. In the West, in particular, declining average size of trees points toward a larger volume of timber cut per unit of sawlog output in the future than at present. Nevertheless, estimates from every region anticipate a net improvement in utilization in the years ahead. How the transition from timber products output to timber cut is made, how progress in utilization was estimated, and the savings in timber cut resulting from it are taken up in the following paragraphs.

Transition from Timber Products Output to Timber Cut

The transition from domestic timber products output to timber cut may be illustrated by 1952 data for softwood pulpwood for the country as a whole (Appendix tables 37 and 75):

	Volume in standard unit (million cords)		Equivalent roundwood volume (million cu. ft.)
Consumption (or requirements)	31.3		2,426
Less net imports	9.9		767
Domestic output (or requirement)	21.4		1,659
Less output from plant residues	1.4		109
Output from roundwood	20.0		1,550
Less output from:			
Dead trees	..	26	
Cull trees and limbs	..	107	
Trees on noncommercial and nonforest land	..	10	
			143
Output from growing stock	..		1,407
Plus logging residues	..		53
Timber cut	..		1,460

In this tabulation, the intensity of utilization is reflected in the relation between volume in standard units and cubic foot volume of roundwood.

The illustration shows that 68.2 cubic feet of growing stock was cut for each cord of domestic output (1460 mm cu. ft./21.4 mm cords). For sawtimber, the comparable utilization factor was 198.7 board feet cut per cord. Similar utilization factors for softwoods and hardwoods were derived for other products.1/

Improvement in Utilization

The improvement in utilization in each region between 1952 and 1975 was estimated from a similar set of utilization factors for 1975. Utilization factors for 2000 were obtained by graphic projections of trends indicated by the factors for 1952 and 1975 with such modifications as utilization conditions for individual regions or products might suggest. Thus, to continue the illustration, the improvement in utilization for softwood pulpwood is indicated by the following factors:

1/ See Appendix C, "Converting Factors."

Year	Timber cut per cord of output	
	Growing stock (cu. ft.)	Sawtimber (bd. ft.)
1952	68.2	198.7
1975	58.4	156.4
2000	50.0	153.0

Savings from Improved Utilization

The savings resulting from the anticipated improvement in utilization is shown by comparing the cut needed to meet estimated future requirements under future utilization practices with the cut which would have been needed to meet these same requirements under the utilization practices of 1952. Thus, the saving in cut for softwood pulpwood in 1975 and 2000 under the lower estimate of requirements would be:

		1975	2000
Requirement	million cords	32.0	52.7
Sawtimber cut per cord:			
1952	bd. ft.	198.7	198.7
Future	do.	156.4	153.0
Associated cut:			
On 1952 utilization base .	million bd. ft.	6,358	10,471
On future utilization base	do.	5,005	8,063
Saving	million bd. ft.	1,353	2,408
	(Percentage)	21.3	23.0

The percentage improvement in sawtimber utilization by products for the country as a whole between 1952 and 1975 and between 1952 and 2000 works out as follows:

	1952-75 (percent)	1952-2000 (percent)
Sawlogs	1.4	1.9
Pulpwood	22.2	26.0
Veneer logs	1.1	2.0
Fuelwood	2.1	2.5
Other products	12.2	18.1
All products	4.5	6.8

The savings attributed to improved utilization for the country as a whole, calculated as outlined above, amount to 5.0 billion board feet under the lower estimate of requirements for 2000, and 6.9 billion board feet under the upper estimate for 2000:

Year	Lower estimate		Upper estimate	
	Sawtimber (billion bd. ft.)	Growing stock (billion cu. ft.)	Sawtimber (billion bd. ft.)	Growing stock (billion cu. ft.)
1975	2.6	0.7	3.1	0.7
2000	5.0	1.5	6.9	1.9

Margin for Contingencies

One reason why a margin is necessary is to provide a hedge against catastrophic losses that will occur in the future. Mortality and growth estimates do not make any allowance for catastrophes such as the Tillamook fires of 1933 in Oregon, the New England blowdown of 1938, or the chestnut blight in the North from 1912 to 1924. Such losses are unpredictable as to time, place, and magnitude. Yet historically such catastrophic losses are estimated to average 2 billion board feet a year.2/

Beyond this, a margin would help provide for unforeseen uses of wood which might be developed by our advancing technology. It would put the Nation in a better position to meet future emergencies. As World War II emphasized, a national emergency may bring unprecedented demands for wood. Also a margin, if realized, would help put this country, with its large potentially productive forest area, in position to help meet the wood needs of timber-deficit countries.

Because the uncertainties increase with the time span, a relatively larger margin is in order for the year 2000 than for 1975. A margin of 5 percent of the potential demand on domestic forests associated with the lower estimate of requirements is assumed for 1975 (table 3). For 2000, the margin is 15 percent. Inasmuch as the upper requirements estimates are substantially larger than lower estimates, the quantitative margins applicable to the lower estimates were added to the upper estimates without change (table 4). The figures obtained by adding these margins to the demand on domestic forests represent the needed future growth.

Timber Size and Quality

Analysis of future timber needs and supply must be primarily in quantitative terms of volume. But size and quality are also important and cannot be ignored.

2/ See Chapter IV, "Forest Protection Against Destructive Agencies," p. 58.

Table 3.--Potential demand on domestic forests and needed growth related to lower estimate of requirements, 1975 and 2000

Item	Sawtimber			Growing stock		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.
1975:						
Potential demand on domestic forests 1/	56.0	40.9	15.1	12.4	8.4	4.0
Margin	2.8	2.0	.8	.6	.4	.2
Needed growth	58.8	42.9	15.9	13.0	8.8	4.2
2000:						
Potential demand on domestic forests 1/	69.0	49.6	19.4	15.7	10.3	5.4
Margin	10.3	7.4	2.9	2.3	1.5	.8
Needed growth	79.3	57.0	22.3	18.0	11.8	6.2

1/ From table 18, Chapter VI. Derived from requirements by the process outlined in the preceding section, "Progress in Utilization." See also table 75 in Appendix A, "A Summary of Basic Statistics."

Table 4.--Potential demand on domestic forests and needed growth related to upper estimate of requirements, 1975 and 2000

Item	Sawtimber			Growing stock		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.
1975:						
Potential demand on domestic forests 1/	65.4	47.6	17.8	14.0	9.6	4.4
Margin	2.8	2.0	.8	.6	.4	.2
Needed growth	68.2	49.6	18.6	14.6	10.0	4.6
2000:						
Potential demand on domestic forests 1/	95.1	68.4	26.7	19.8	13.0	6.8
Margin	10.3	7.4	2.9	2.3	1.5	.8
Needed growth	105.4	75.8	29.6	22.1	14.5	7.6

1/ From table 18, Chapter VI. Derived from requirements by the process outlined in the preceding section, "Progress in Utilization." See also table 75 in Appendix A, "A Summary of Basic Statistics."

Major Emphasis on Sawtimber

It is incorrect to relate needed growth to cut or requirements in terms of cubic feet without reference to tree size because the estimates of future wood needs involve certain assumptions as to size. For example, lumber, the dominant element in future requirements, must be obtained from trees of sawtimber size. Moreover, much of the lumber, including that for many structural items, requires trees substantially above the minimum sawtimber specifications of 9 inches in diameter for softwoods and 11 inches for hardwoods. Veneer logs and bolts, poles, and piling likewise require trees above the minimum sawtimber size.

In the future, as at present, the major portion of the wood needs of the United States will come from trees above the minimum sawtimber sizes. Not only do products requiring trees of sawlog size predominate in the projections of future requirements, but also, for all major classes of products, it is usually more economical to harvest a given volume from trees above the minimum sawtimber sizes than from trees of small size.

Thus the long-range requirements will not be fully met unless the growth in terms of cubic feet of growing stock 5 inches or more in diameter includes enough timber above the minimum sawtimber sizes to supply the needed board-foot growth.

This is important because, as pointed out in Chapter III (page 40), the size components in annual growth are not the same as in timber cut. Timber cut is obtained primarily from trees of sawtimber size, whereas annual growth is more uniformly distributed among all tree size classes. The differing relationships can be illustrated by the figures for 1952.

	Sawtimber (billion bd. ft.)	Growing stock (billion cu. ft.)	Ratio of bd. ft. to cu. ft.
Timber cut	48.8	10.7	4.5
Net growth	47.4	14.2	3.3

The higher ratio of board feet to cubic feet in timber cut as compared to that in net growth means that the size of trees in timber cut averaged higher than in net growth.

The ratios of board feet to cubic feet in the estimates of timber cut needed to meet future requirements are:

Year	Lower estimate	Upper estimate
1975	4.5	4.7
2000	4.4	4.8

Since these all approximate or exceed the ratio in 1952 cut, and all are above the 3.3 ratio for net growth, meeting the sawtimber requirements would involve more cubic-foot growth than needed to meet the

cubic-foot volume requirements without regard to timber size. Thus a surplus of cubic-foot growth alone is not a guarantee that sawtimber requirements will be met. Primary emphasis should be directed to meeting the sawtimber needs.

Average Size of Timber Declining

The distinction between sawtimber and poletimber is the only available criterion of tree size in our estimates of requirement and annual growth. This is unfortunate because tree size is correlated with timber quality and the distinction between sawtimber and poletimber does not adequately reveal quality changes associated with changes in the size of trees harvested. Ordinarily reduction of average size of trees cut means a reduction in the quality of product, an increase in the unit costs of harvesting and processing, or both. Reduction of quality is primarily important in sawn products, veneer, and specialty products. But increase in unit costs is generally significant for all products.

It is common observation that, if the forests in any region become depleted, trees of smaller and smaller size and poorer and poorer quality become merchantable while trees of large size and high quality make up a smaller and smaller proportion of the total cut. Thus the average size and quality of trees cut may continue to drop even though the proportion of the total cut taken from sawtimber remains constant.

The downward trend of average size of trees cut in the West is still in its early stages. However, in the East it is doubtful if the trend for softwoods will go much lower.

The downward trend of tree sizes utilized has positive as well as negative aspects. It creates opportunity for greater use of thinnings which would otherwise go to waste. It usually involves a lowering of the percentage of cull. But it also carries the danger of premature cutting of crop trees at a size when they have barely entered the stage of greatest productivity.

Timber Quality on the Downgrade

There are other signs that timber quality is deteriorating. High grade logs are becoming scarce in one species after another. Select logs of eastern white pine, for example, have long been practically nonexistent. The Douglas-fir plywood industry no longer depends upon logs meeting the rigid specifications formerly required for the "peeler" grade. Top grade hardwood logs are harder and harder to find. In the Northeast, much of the hardwood forest has been subject to long years of cutting of the choicest timber and leaving poorer trees to take over the growing space. In other areas, repeated clear cutting and fire have been followed by inferior and defective stands of sprout origin. As a result, much of the hardwood timber now on the land cannot find a ready market. During World War II, the unprecedented demand for dunnage and crating provided a welcome outlet for this low-grade timber. But now the high proportion of low-grade material again limits the opportunity for forest management practices which will improve the quality of timber growth for the future.

Evidence presented in Chapter II showed that two-thirds of the softwood sawtimber volume in the East is in trees 14 inches or less in diameter, and that little more than one-fourth of the hardwood volume is in trees over 18 inches in diameter, the size needed to yield significant amounts of grade 1 sawlogs. In addition, it showed cull trees, with a volume equal to one-fourth of the hardwood growing-stock volume, occupying space which might otherwise be used by good quality timber.

Since much of the growth between now and 2000 will be on growing stock already on the ground, and since the quality of ingrowth and plantation yields before 2000 will likewise average low, the available evidence points toward a continuing decline in quality of growth for several decades. Until this trend is reversed, it will be increasingly difficult to meet future requirements for sawtimber quality.

Relation of Needed Growth to Present Growth

The estimates of needed growth indicate the desirability of achieving an annual sawtimber growth of from 79 to 105 billion board feet by 2000. Yet sawtimber growth in 1952 was only 47.4 billion board feet. Thus, whether the lower or upper estimate of needed growth is taken as a national objective, the productivity of the forests will have to be greatly increased. Sawtimber growth would have to be more than doubled to reach the upper estimate for 2000. It would have to be increased 67 percent to reach the lower estimate (table 5). The needed increase is, of course, much smaller for 1975. Part of the increase may be expected to follow naturally as young growth comes in after cutting on areas now occupied by old growth.

In terms of cubic feet, the upper estimate of needed growth in 2000 is only a little more than 50 percent above 1952 growth of 14.2 billion cubic feet. However, as pointed out in the preceding section, balancing the cubic-foot requirements would not suffice unless the size-distribution were such as to yield as many board feet per cubic foot as indicated in the estimates of needed cut. If the ratio of sawtimber growth to cubic-foot growth is no better than at present, the cubic-foot growth required to yield sufficient sawtimber to meet the upper estimate of board-foot requirements for 2000 plus the margin would be 31.6 billion cubic feet rather than 22.1 billion cubic feet.

The sawtimber growth deficit is primarily in softwoods. Even the lower estimate of needed growth for softwoods in 1975 is 53 percent above current growth (table 5 and fig. 3). The upper estimate for 2000 exceeds current growth 171 percent. For hardwoods, the 1975 need, even in the upper estimate, is less than current growth. However, the upper estimate for hardwoods in 2000 is 53 percent above current growth.

The relatively easy goals for hardwoods as compared to those for softwoods suggest the need to substitute hardwoods for softwoods whenever possible, in order to lighten the load on the latter. A substantial substitution of this sort was assumed in the requirements estimates. The product-by-product estimates of lower-level requirements envisage a 100 percent increase in the use of hardwoods for industrial purposes

Table 5.--Annual growth, 1952, and two estimates of needed growth for 1975 and 2000, United States and Coastal Alaska

Item	Sawtimber			Growing stock		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.
Annual growth, 1952	47.4	28.0	19.4	14.2	7.0	7.2
Lower estimate of needed growth:						
1975	58.8	42.9	15.9	13.0	8.8	4.2
2000	79.3	57.0	22.3	18.0	11.8	6.2
Upper estimate of needed growth:						
1975	68.2	49.6	18.6	14.6	10.0	4.6
2000	105.4	75.8	29.6	22.1	14.5	7.6

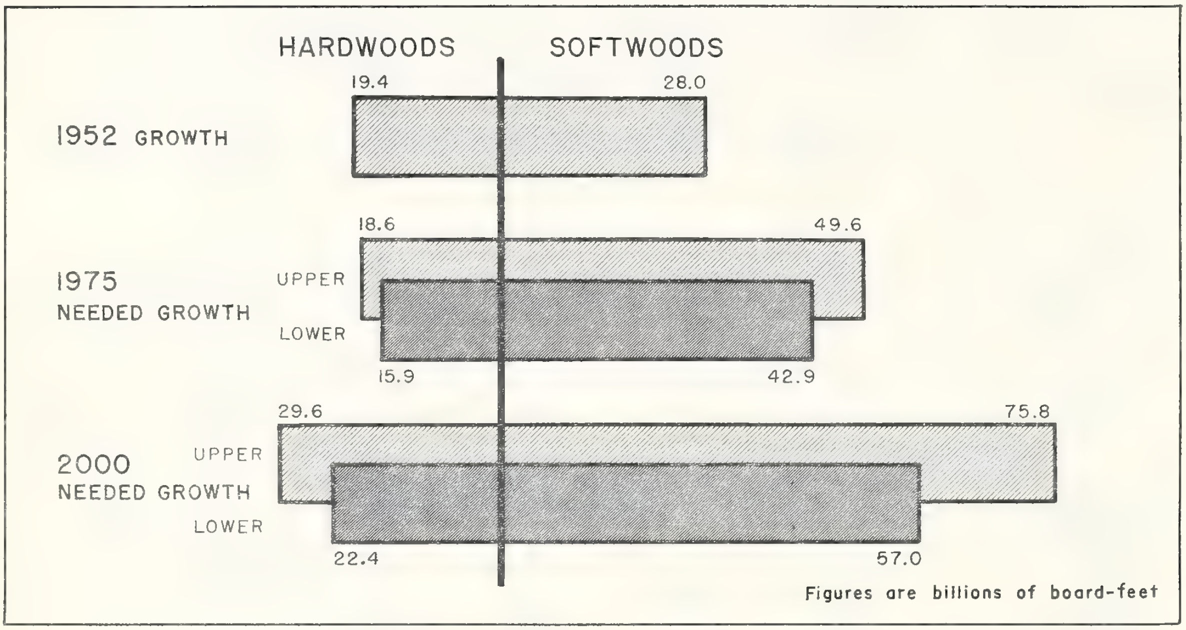


Fig. 3 - Comparison of 1952 sawtimber growth with upper and lower estimates of needed growth for years 1975 and 2000, United States and Coastal Alaska.

between 1952 and 2000, whereas the increase in softwoods is only 40 percent. In the same period, however, a drastic reduction is expected in the use of fuelwood. Since most of the wood cut for fuel is hardwood, the trends tend to compensate. Accordingly, not until after 1975 does the estimate of needed hardwood growth rise above the volume of growth in 1952.

Needed Growth Approaches Realizable Growth

One measure of the significance of needed growth is its relation to realizable growth. For the reason discussed in the two previous sections, the most significant relations are those for sawtimber. The upper estimate of needed sawtimber growth for 2000 approximates realizable growth; in fact, the needed softwood growth is 6 billion board feet in excess of the indicated realizable growth for softwoods. Even the lower estimate of needed growth for 2000 means achieving over 80 percent of the realizable growth for softwood sawtimber:

	Needed growth, 2000		Realizable growth
	Lower estimate (billion bd. ft.)	Upper estimate (billion bd. ft.)	(billion bd. ft.)
Softwood	57.0	75.8	69.7
Hardwood	22.3	29.6	31.0
Total	79.3	105.4	100.7

In considering these figures, it is well to recognize that there is some interchangeability between hardwoods and softwoods; that is, some areas will grow either hardwoods or softwoods depending on the character of the forestry practiced. It may be physically and economically feasible to obtain a higher proportion of softwoods than indicated by the estimates of realizable growth. On the other hand, the figures on realizable growth may already overestimate the success of forest management in holding land for softwood production against the encroachment of hardwoods. In any event, there is very little margin between the upper estimate of needed growth for 2000 and realizable growth for hardwoods. Furthermore, the requirements estimates have gone as far as recent trends and outlook seem to warrant in building up the proportion of hardwoods in the estimates of needed growth.

All in all then, substitution of hardwoods for softwoods will not offset the excess of needed growth in 2000 over realizable growth for softwood sawtimber. But the apparent disparity does not mean that the upper estimate of needed growth in 2000 is impossible to achieve.

The estimate of realizable growth is a flexible thing. Forest productivity, like farm productivity, is closely tied to intensity of management. No one can estimate with any precision the intensity of management and therefore the timber growth that is likely to be feasible to develop under any particular future economic conditions. Moreover, the estimate

of realizable growth is much less than the biological potential of the land so that there is substantial room for realizable growth to increase if conditions are more favorable. Nevertheless, because it will never be possible to have all the forest land managed at the best level which is economically or biologically feasible, it will not be easy to achieve either the lower or upper estimate of annual growth to meet the Nation's needs in 2000.

Needed Growth Is Higher Than Previously Supposed

The estimates of needed growth for 2000 shown in tables 3 and 4 are considerably higher than the comparable long-range estimates in the 1945 Reappraisal report of the Forest Service. In comparing the figures, it is necessary to deduct the allowance for losses from the Reappraisal goals to put them on the same basis as the estimates in this report:

	Needed growth, 2000	
	Sawtimber (billion bd. ft.)	Growing stock (billion cu. ft.)
Reappraisal (1945)		
Growth including losses	72.0	20.0
Net growth	68.8	18.7
Timber Resource Review	79.3 - 105.4	18.0 - 22.1

It is only necessary to consider the change in population expectations of this country to understand why, other things being equal, estimates of needed timber growth had to be raised. In 1945, the long-range requirements were based on the assumption that population would be about 167 million in the year 2000. Changes in the birth rate since 1940 have forced revision of this estimate; in fact, the population has already gone beyond 165 million. It is now estimated that a medium rate of increase will result in 275 million people in 2000. This prospect, paralleled by a continuing expansion of industry, overbalances all other considerations and makes higher estimates of needed growth inescapable.

TIMBER VOLUME TO SUSTAIN NEEDED GROWTH

A useful criterion of the present and prospective timber situation is an estimate of the volume--and in particular the volume in trees of sawtimber size--which would have to be present as a base to sustain the future growth needed to supply the potential demand indicated by the requirements estimates. For example, so long as the West has a substantial backlog of virgin timber, a decline of western timber inventory is to be expected. That decline becomes serious only if it carries the timber inventory below the level needed to support the desired level of growth.

Such bench marks of needed timber volume are useful, however, only by regions or sections; and in the East only when softwoods and hardwoods are considered separately. Thus, to provide such bench marks, it is first necessary to apportion the estimates of needed growth for the

country as a whole among the forest regions and then estimate the volume of timber needed in each region to sustain these regional allocations. In this process, the national estimates of needed growth were apportioned to the regions in direct proportion to their realizable growth. For example, the Southeast region has 25 percent of the total realizable growth for softwoods. It should, therefore, provide 25 percent of the total needed softwood growth.

The needed timber volume for each region was determined by capitalizing the region's share of needed growth at an appropriate rate. The rate used represents a weighted average mean annual growth (including growth harvested in thinnings or intermediate cuttings) of well stocked stands of the region's important timber types at appropriate rotation ages. The rotations selected were those deemed necessary on the average to provide timber of the size and quality implicit in the requirements estimates under the intensity of protection and management which might prevail at the end of the century.

The calculations of needed inventory were made independently in each region. Indicative of the rotations on which these calculations were directly or indirectly based are the following:

Southern yellow pine . . . . 60 years
Eastern hardwoods . . . . 80 years
Douglas-fir . . . . 100 years
Ponderosa pine . . . . 120-150 years

In such calculations, the longer the rotation age needed to produce the desired range of size classes, the greater the ratio of timber volume to annual yield and the smaller the capitalization rate to convert needed growth to needed inventory.

When the results from all regions are brought together, the rates at which needed growth is capitalized average as follows:

	Capitalization rates	
	Sawtimber (percent)	Growing stock (percent)
Eastern softwoods	5.4	4.6
Eastern hardwoods	4.4	4.0
Western species:		
Douglas-fir subregion	3.7	3.3
Other Western regions	2.8	2.0

The growing stock required to yield the growth needed in 2000 is compared to sawtimber volume in 1953 in table 6. Sawtimber volume in the West is still substantially in excess of the amount required. In the East, however, sawtimber volume is far below what it should be. For eastern softwoods it appears that sawtimber growing stock would need to be increased 2½ times to yield the lower estimate of needed growth in 2000 and 4 times to yield the upper estimate. The needed increase in eastern hardwood volume is 30 percent for the lower estimate of needed growth in 2000 and 100 percent for the upper estimate.

Table 6.--Timber volume needed to sustain lower and upper estimates of needed growth in 2000

Species group	Sawtimber - needed volume, 2000		1953	Growing stock - needed volume, 2000		1953
	Lower estimate	Upper estimate	volume	Lower estimate	Upper estimate	volume
	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.
Eastern softwoods	598	970	242	147	181	74
Eastern hardwoods	503	769	381	152	186	151
Western species	793	1,057	1,434	212	260	292
Total	1,894	2,796	2,057	511	627	517

HOW CUTTING OF REQUIREMENTS WITH MARGIN FOR CONTINGENCIES WOULD AFFECT FUTURE TIMBER GROWTH AND VOLUME

Previous chapters have shown that the Nation's timber situation is much brighter than it was a decade ago. In considerable part, the improved situation is attributable to the progress that has been made in forestry during the past few decades. Against this progress is the evidence that the Nation's future timber needs are destined to be much greater than previously supposed. The question to be considered, then, is whether there is sufficient momentum behind current forestry trends to keep timber growth abreast, if not ahead, of the rapidly rising requirements of our expanding population and economy.

One way to weigh this question is to project the impacts of future cutting and forestry progress upon timber growth and volume for a period of several decades. In such projections, the key factors are the rate of forestry progress and the pattern of timber cut3/ assumed for the projection period.

Two projections were made: First, it was assumed that the annual timber cut would climb steadily from what it was in 1952 to the lower estimate of demand on domestic forests in 1975 with a 5 percent margin for contingencies (the needed growth for that year), and then to the lower level of demand on domestic forests with a 15 percent margin in 2000. Second, another projection, with the pattern of cut similarly related to the upper-level requirements, was developed. Henceforth, these two projections are referred to as the lower and upper projections.

In both the lower and upper projections, it was assumed that forestry in each region will continue to progress at a rate which appears likely from recent trends. What this implies needs to be considered in some detail.

ANTICIPATED PROGRESS IN FORESTRY

The assumption that forestry will continue to progress at a rate which appears likely from recent trends requires that consideration be given in each region to the effect of the anticipated improvement in protection and management and of future planting on future growth.

More intensive protection and management will increase future net growth in two ways--by increasing the gross amount of timber grown and by reducing losses. Gross growth is being increased as good cutting practices and protection from fire provide for the establishment of young growth on areas formerly occupied by virgin timber. Increased growth will result from building up growing stock in depleted and understocked forests, from removal of cull trees, and from better and quicker reproduction on cutover areas.

3/ In these projections, "timber cut" is assumed to include the margin for contingencies.

Growth will also be increased as weeding, thinning, and other cultural measures become more commonly applied in young stands. At present, such measures are being applied in ownerships which comprise 21 percent of the commercial forest land. However, since the area actually being treated is only a small fraction of these ownerships, it is apparent that no more than a bare start has been made in cultural practices to improve the composition, quality, and growth of future timber stands. Nevertheless, the area in ownerships on which some timber stand improvement is done was very much smaller 20 years ago than at present. It is reasonable to expect that on public and industrial timber holdings, where the best start has been made in stand improvement, such work will be more extensively applied in the future. Not so much progress may be expected for the forest lands in farms and other small private ownerships.

Losses are being reduced by progress in protection from fire, insects, and diseases. Partial cutting in old growth of certain types is another way in which losses are being reduced. As good management is more widely applied, premature cutting with its attendant growth loss will be less important. Losses are also reduced as more intensive management reduces the incidence of insects and diseases and increases the salvage of timber that is killed by destructive agents. Similarly, losses are reduced as more intensive management forestalls suppression and increases the volume of timber harvested in thinnings and other silvicultural operations.

All of these trends were taken into account in the changing rates of gross growth, ingrowth, and mortality applied period by period in each of the regional projections of growth and inventory. It is important to note, however, that while these elements of progress all tend to increase the volume of net growth, percentage rates of growth may be reduced as growing stock is built up in depleted and understocked forests. And by the same token, losses under a given intensity of protection and management may also increase as the volume of growing stock exposed to loss increases.

Continuation of recent trends in forestry means an advance not only in the acreage under protection and management but in the intensity of protection and management being applied. The following paragraphs give some indication of anticipated progress in two fields: protection and planting.

Because losses from destructive agents are related to the volume of timber subject to loss as well as to the intensity of protection, progress in protection is best stated in terms of the rate of loss as a percentage of timber volume. In 1952, the mortality rate for the country as a whole was 0.6 percent of timber volume. Regional estimates indicate that it will not be feasible to reduce this rate much below 0.4 percent by 2000. In this estimate of feasible reduction, rates for the North and South were halved, but a change of less than 10 percent was assumed for the West where increased public use of the forest and an increasing amount of timber cutting will offset greater protection effort. In some areas, this could even mean that the mortality rate percent might increase. Nevertheless, because of further reduction in the volume of standing timber in the West, a 10 percent improvement in rate of loss by 2000 would result in cutting the actual volume loss in half.

The projections assume that most of the preventable losses will be eliminated. Not much of the anticipated reduction can be expected from further reduction in the rate of forest fire losses. Organized protection in 1953 included 92 percent of the forest area of the United States, exclusive of Alaska, as compared with 80 percent in 1945. Sawtimber losses from other causes in 1952 were 15 times as great as those from fire. Clearly, the principal reductions of mortality rates in the future will have to come from improved protection against insects and diseases and from thinning and other silvicultural measures which will reduce losses from suppression.

The second element of anticipated forestry progress for which quantitative estimates were made is a further increase in the productive forest area by the planting of lands now idle. The projections assumed that the extremely rapid increase in forest planting since World War II will continue for another decade after which the area of successful new plantings will level off at somewhat less than 800,000 acres a year (fig. 4). Planting will be of greatest importance in the South where it is anticipated that 2.8 million acres will be planted in the 5-year period 1960-1964, as compared to 1.4 million acres in 1950-1954. For the country as a whole, plantings between 1952 and 1985 are likely to total 25 million acres, much of which will be contributing to growing stock in trees over 5 inches in diameter by the end of the century. It is estimated that plantations established subsequent to 1952 will contribute about 1.1 billion cubic feet to growth of growing stock and 5.4 billion board feet to sawtimber growth in 2000.

THE LOWER ESTIMATE OF NEEDED GROWTH MAY BE REACHED

The lower projection shows what would happen to forest growth and timber volume if recent progress in forestry is continued and if sawtimber cut increases from the level of timber cut in 1952 up to 58.8 billion board feet in 1975 and to 79.3 billion board feet in 2000 (table 7). This pattern of cut would satisfy a lower range of the country's potential demand up to the end of the century.

The analysis was carried forward region by region by technicians familiar with field conditions. In order to do this, the national estimates of needed cut in 1975 and 2000 with a margin for contingencies (needed growth) were allocated among the regions taking the existing situation and recent trends in each region into account (fig. 5).

In this allocation, the needed increase in cut of eastern softwoods was held down for the next 20 years because of present depletion of growing stock. After 1975, a more rapid rate of increase was assumed, but this would still leave the drain in 2000 substantially below the long-range estimate of realizable growth.

For eastern hardwoods, the needed increase in cut was slower in the first 23 years than in the period after 1975 because the estimate of lower requirement did not envisage that commercial use of hardwoods would be expanded any more rapidly.

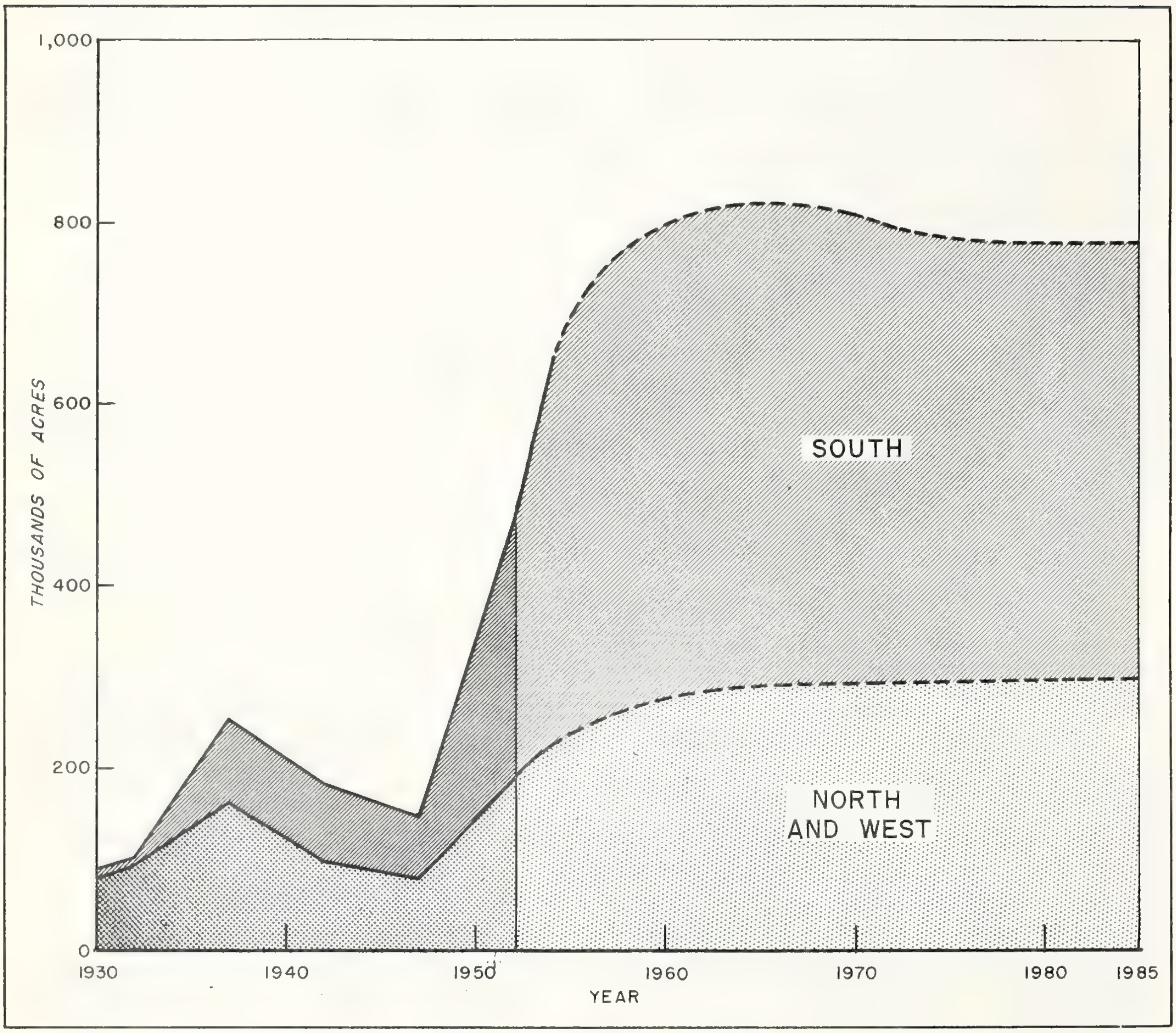


Fig. 4 - Trends of forest planting (acceptable plantations) in the United States.

Table 7.--Projected net growth and timber inventory with timber cut to meet lower estimate of requirements plus margin

Item and species group	Sawtimber			Growing stock		
	1952[3]	1975	2000	1952[3]	1975	2000
	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.
Net growth:						
Eastern hardwoods	19.1	24.1	25.6	7.1	9.1	9.4
Eastern softwoods	17.0	20.7	23.0	4.4	5.4	5.5
Western species[1]	11.3	16.3	18.1	2.8	3.7	4.2
Total	47.4	61.1	66.7	14.3	18.2	19.1
Inventory:						
Eastern hardwoods	381.2	542.1	731.9	151.0	241.4	357.5
Eastern softwoods	241.9	310.3	385.3	74.2	96.4	116.2
Western species[1]	1,433.8	1,188.8	885.0	291.7	266.7	235.7
Total	2,056.9	2,041.2	2,002.2	516.9	604.5	709.4
Timber cut:[2]						
Eastern hardwoods	12.2	15.7	22.2	3.2	4.2	6.1
Eastern softwoods	14.1	15.7	24.9	3.7	4.0	6.2
Western species[1]	22.5	27.4	32.2	3.8	4.8	5.7
Total	48.8	58.8	79.3	10.7	13.0	18.0

1/ Coastal Alaska included.
2/ Includes margin for contingencies.
3/ Beginning of 1953 for inventory.

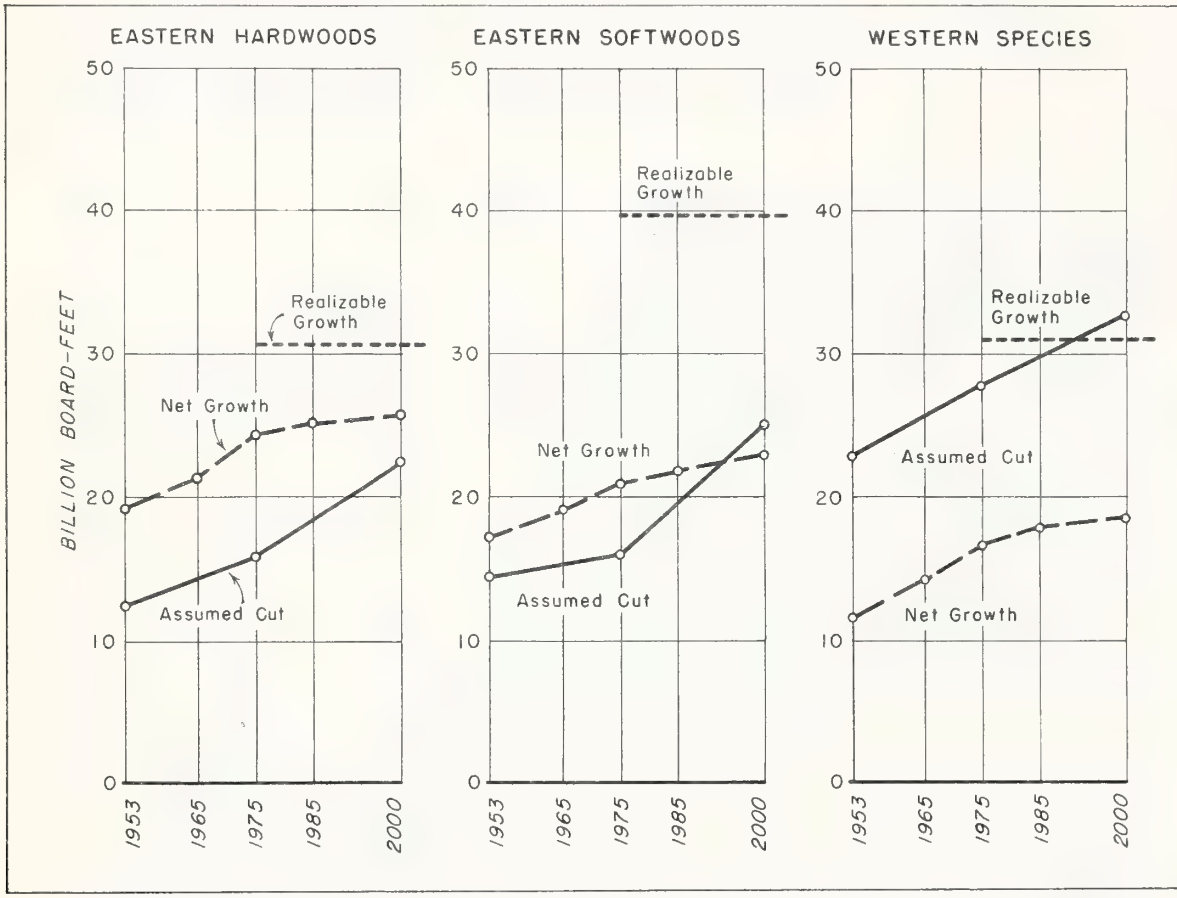


Fig. 5 - Assumed cut and resulting net growth in lower projection and realizable growth, United States and Coastal Alaska.

In the allocation of cut, the West, with its backlog of old-growth timber, was called upon for a steady increase rising 2 billion board feet above the present estimate of realizable growth by 2000.

Net Growth Increases in Lower Projection

Though somewhat less than appears to be needed, the outlook for future growth and timber volume under the lower projection is encouraging.

Net growth would increase steadily to the end of the century (fig. 6). Sawtimber growth of all species together would keep pace with the advancing cut until 1985 but then fall below it. Growth of growing stock would keep ahead of cut until the end of the century.

In the East, sawtimber growth would increase 35 percent between 1952 and 2000 (table 7 and fig. 5). The percentage increase is about the same for softwoods and hardwoods. In the West, the increase of sawtimber growth would be 60 percent. The greater increase in the West is doubtless related to the replacement of old growth with more vigorous forests as cutting progresses into presently virgin areas.

Build-Up of Eastern Softwood Inventory Not Enough to Sustain Needed Growth

In the lower projection, sawtimber inventory of all species would hold almost constant, just above 2000 billion board feet (table 7 and fig. 6). To maintain this level, however, declining sawtimber volume in the West would be offset by a consistent build-up of both softwoods and hardwoods in the East. Eastern hardwoods would gain 92 percent and eastern softwoods 59 percent. Inventory of growing stock would rise steadily, increasing 37 percent from 517 billion cubic feet to 709 billion cubic feet. Here again a more moderate decline in the West is more than offset by accumulation of growing stock in the East.

Before 1975, eastern hardwood sawtimber inventory would have accumulated beyond the 503 billion board feet needed to sustain the lower estimate of needed hardwood growth (table 6). But eastern softwood inventory in 2000 would still be 213 billion board feet or 36 percent short of the 598 billion board-foot required growing stock. By 2000, western sawtimber inventory would be reduced about 38 percent to 885 billion board feet. But it would still be 92 billion board feet above the minimum required to sustain the estimate of needed growth allocated to the West. Thus, despite an increase in growth of all species groups and maintenance of the over-all level of inventory, it is significant that the increase in eastern softwood inventory in the lower projection would not be sufficient to sustain the lower estimate of softwood growth needed in the East.

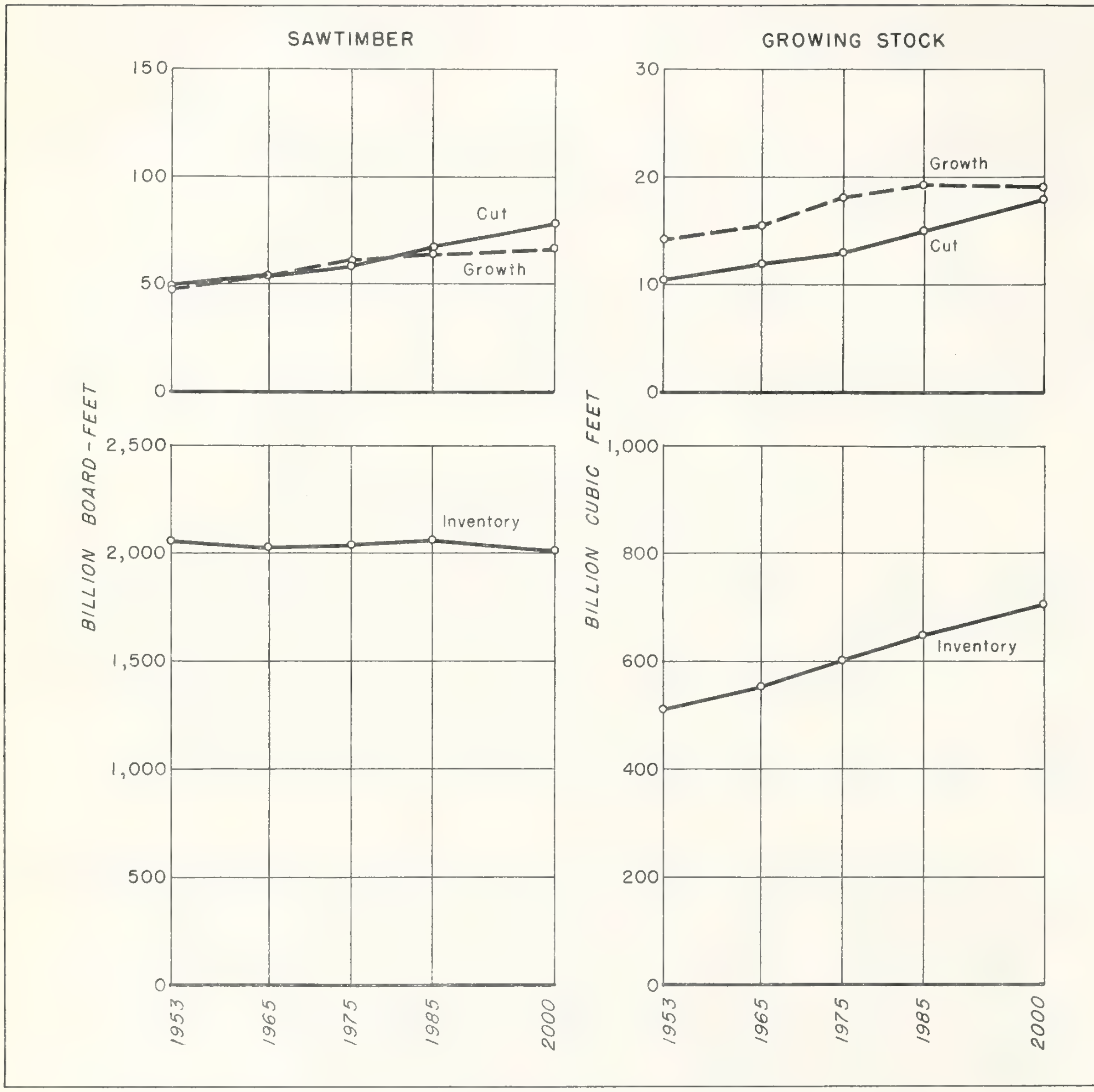


Fig. 6 – Assumed cut and resulting growth and inventory in lower projection, all species.

One-Third of Sawtimber Volume and Still Larger Proportion of Sawtimber Growth in 2000 Attributed to Anticipated Progress in Forestry

Because emphasis has been placed on the anticipated progress in forestry assumed in the projections, an estimate has been made of how much of the timber inventory and annual growth shown for 2000 in the lower projection may be attributed to forestry progress. In this analysis, it was possible to calculate separately the contribution to future sawtimber inventory of three elements of anticipated forestry progress. The projected sawtimber growth for each of the three major species groups in 2000 was then prorated to sources on the same bases as shown for volume. The three elements of progress segregated were: (1) Plantations established after 1952, (2) reduction of the percentage rate of mortality below that of 1952, and (3) ingrowth, other than that from plantations, in excess of the 1952 rate. In the analysis, it was assumed that the annual cut would be taken from growing stock now on the ground as augmented by future growth on it and by ingrowth continuing at the present rate, rather than from the new growth resulting from further progress in forestry.

One-third of the sawtimber stand shown for 2000 in the lower projection will result from assumed progress in forestry (table 8). For western species and for eastern hardwoods, about 80 percent of the volume projected for 2000 will be related to the 1953 base and elements of progress which could not be evaluated separately. About 20 percent can be attributed to reduction of mortality below the rates prevailing in 1952 and to increase in ingrowth above the rates prevailing in 1952. In each of these species groups, increased ingrowth would account for somewhat more of the volume in 2000 than mortality reduction.

For eastern softwoods, over 90 percent of the sawtimber inventory projected for 2000 would be related to the assumed progress in forestry. About 23 percent is attributed to plantations established after 1952. Another 28 percent is attributed to reduction of mortality below the 1952 rate. At least 41 percent is attributed to ingrowth in excess of the rate prevailing in 1952. Increased ingrowth would probably be responsible for more than the 41 percent of softwood inventory shown because for the Southeast and West Gulf regions it was only possible to account for increased ingrowth due to cull-hardwood removal. That which might result from better protection or other factors could not be segregated in these two important softwood regions.

The 1953 stand of 242 billion board feet of eastern softwoods, with the growth rate and ingrowth prevailing in that year, would be reduced to a mere 30 billion board feet by 2000 if it bore the entire brunt of the assumed cut in the intervening years. As a matter of realism, this would not be the case. New stands generated by further forestry progress would contribute to the annual cut, not only in thinnings but also to some extent in harvest cuttings, before the end of the century. Nevertheless, the calculation gives a fair picture of how badly the eastern softwood inventory would be depleted by the lower projection's 10 billion board-foot increase in annual cut in this species group, if forestry programs were no more effective than in 1952.

Table 8.--Sources of sawtimber volume in 2000, lower projection

Source	All species		Eastern hardwoods		Eastern softwoods		Western species	
	Billion bd. ft.	Percent	Billion bd. ft.	Percent	Billion bd. ft.	Percent	Billion bd. ft.	Percent
Plantations established after 1952	93	5	..	..	89	23	4	1
Reduction of mortality below 1952 rate	242	12	68	9	110	28	64	7
Ingrowth in excess of 1952 rate	335	17	89	12	157	41	89	10
Residuum of 1953 stand and factors not segregated	1,332	66	574	79	30	8	728	82
Total	2,002	100	731	100	386	100	885	100

When sawtimber growth in 2000 for each species group is prorated to sources on the same basis as volume, it appears that 45 percent of the sawtimber growth in 2000 will be the result of progress in forestry subsequent to 1952 (table 9).

Indicated Trends of Growth May Be Difficult to Improve

Although growth trends in the lower projection are steadily upward, the analyses indicates a deficit in 2000 of over 12 billion board feet under the increased cut assumed. Although a small surplus of growth over cut of total growing stock is shown for 2000, this is the result of a 2.2 billion cubic-foot deficit in softwoods being offset by a 3.3 billion cubic-foot surplus in hardwoods. If the growth trends could be stimulated so as to sustain the rate of increase projected up to 1975, the lower estimate of needed growth could be achieved. However, there are a number of considerations, other than the need for continued progress in forestry, which indicate that the trends of growth may be difficult to improve. Discussion of these matters is only in terms of sawtimber because the relations shown in terms of growing stock are essentially the same, differing only in dimensions.

In the West, the projection shows sawtimber cut increasing more rapidly than growth after 1975 (fig. 5). This is significant because the excess of western cut over growth should be tapering off rather than increasing. Cutting more than annual growth in the West cannot continue forever. In fact, with western sawtimber inventory reduced to a point where it is only 12 percent above the minimum required to sustain the allocated cut, a balance of cut and growth should be in sight by 2000. As it is, the surplus growing stock shown in the projection for 2000 would be no more than enough to take care of 7 years of overcut at the rate indicated for that time.

It would not be feasible for eastern softwoods to absorb any of the excess cut from the West because eastern softwood cut rises above projected growth at the end of the century. Even though eastern softwood growing stock has been favored in the projection by allocating to eastern softwoods only a small increase in cut prior to 1975, better forestry and better yields than assumed in the projection will be needed for eastern softwoods to sustain the cut already alloted to them.

Some relief for this critical softwood outlook might be found if a larger part of the output were to come from hardwoods. This implies acceptance of hardwoods for construction, woodpulp, and other industrial purposes on a far larger scale than can be visualized on the basis of current trends. The problem of making full use of the prospective growth of hardwoods has been referred to at several times. It should not be passed over lightly at this point. Nevertheless, although hardwood growth remains some 3.4 billion board feet above the projected cut in 2000, the annual surplus is seen to be diminishing as cut rises rapidly and growth levels off. In any event, the hardwood surplus, which may reach a maximum of 8 billion board feet in 1975 before tapering off to 3 billion in 2000, would not go far in offsetting the 16 billion board-foot softwood deficit for 2000. Its earlier use,

Table 9.--Sources of sawtimber growth in 2000, lower projection[1]

Source	All species		Eastern hardwoods	Eastern softwoods	Western species
	Billion bd. ft.	Percent	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.
Plantations established after 1952	5.4	8	..	5.3	0.1
Reduction of mortality below 1952 rate	10.2	15	2.4	6.5	1.3
Ingrowth in excess of 1952 rate	14.3	22	3.1	9.4	1.8
Residuum of 1953 stand and factors not segregated	36.8	55	20.1	1.8	14.9
Total	66.7	100	25.6	23.0	18.1

1/ Obtained by applying percentage distributions among causes for each species group from table 8 to total projected growth for that group and adding to get "All species" distribution.

however, might permit a more substantial build-up of eastern softwood growth.

The softwood outlook would, of course, be relieved in some degree if some of the margin for contingencies should not be needed.

UPPER ESTIMATE OF NEEDED GROWTH POSES A TREMENDOUS CHALLENGE

The lower projection indicates that to supply even the lower range of potential demand on a sustained yield basis beyond 2000 with a reasonable margin for contingencies will require even greater improvement and extension of good forest management than was assumed in continuation of recent trends. It is obvious that to supply the upper level of potential demand will be considerably more difficult. Yet because of the desirability of maintaining the position of timber in the national economy and to avoid the relative price increases for timber products implicit in the lower range of demand, this challenge should be considered.

The upper projection analyzes the effect of increasing the cut from the level of the 1952 cut (48.8 billion board feet) to 68.2 billion board feet in 1975 and to 105.4 billion board feet in 2000. These figures represent the level of potential demand which would maintain timber in the same position relative to all physical structure materials as it held in 1952, with the same margins for contingencies as in the lower projection. Like the lower projection, this projection assumes that forestry will progress in each region at a rate which appears likely from recent trends.

In the allocation of needed cut and margin for the upper projection, the West was called upon for an increase which would rise above the present estimate of realizable growth for sawtimber after 1972, even though it is unlikely that cutting at such a rate could be indefinitely sustained (fig. 7). For eastern softwoods, the more rapid increase of cut in this projection would still leave it some 6.4 billion board feet below realizable growth in 2000. For eastern hardwoods, in spite of marketing problems, the assumed cut and margin comes within 2 billion board feet of the realizable growth.

Upper Projection Would Turn the Trend of Growth Downward

The encouraging increase in annual growth, which has been among the significant developments in the timber situation in recent years, would not carry beyond 1975 under the impact of the increasing cut predicated in the upper projection. After that time, annual growth of both sawtimber and growing stock would turn sharply downward. By 2000, annual growth (25 billion board feet) would be less than one-fourth of the assumed cut plus margin (105 billion board feet) (table 10 and fig. 8).

For western species, annual growth would continue to increase until 1985. After that time, the drop in sawtimber growth would be rapid (fig. 7), although the growth of growing stock would not drop much, at least not before 2000.

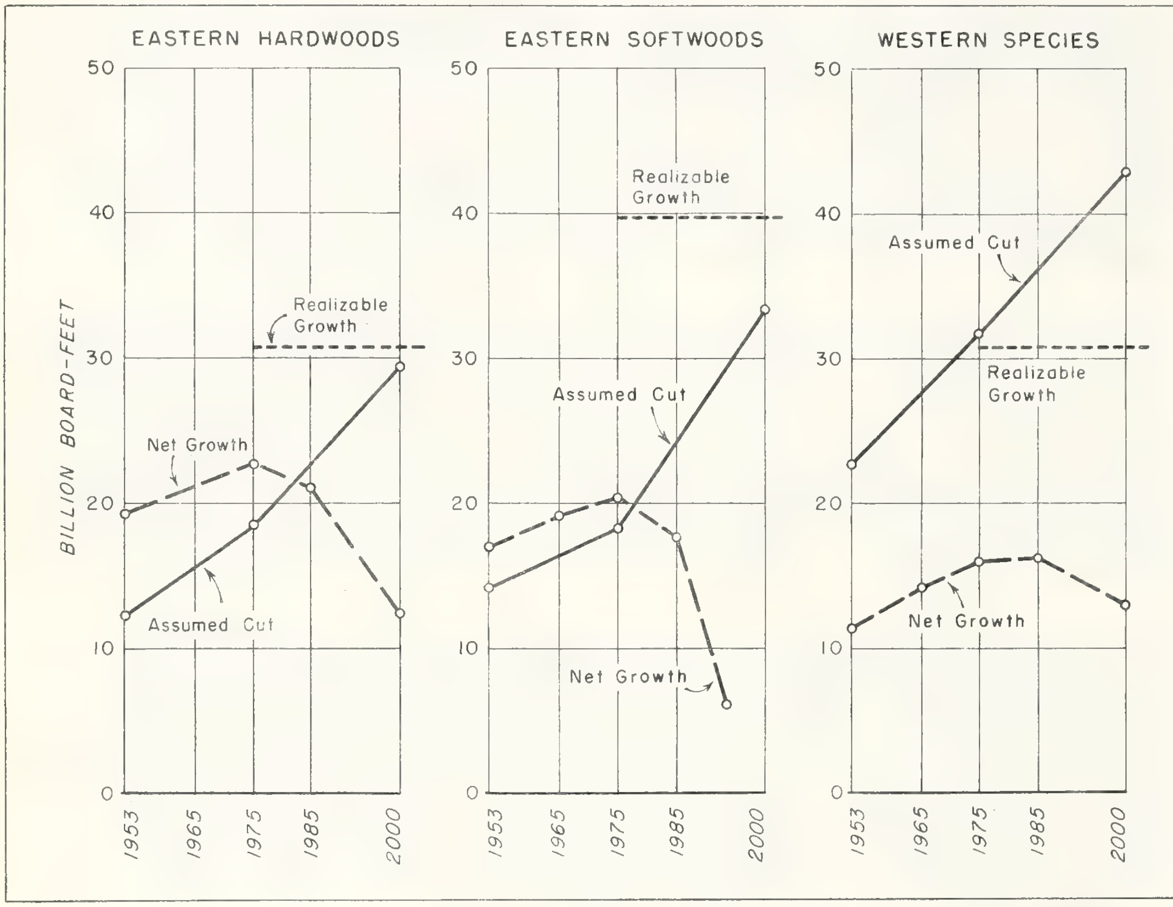


Fig. 7 — Assumed cut and resulting net growth in upper projection and realizable growth, United States and Coastal Alaska.

Table 10.--Projected net growth and timber inventory with timber cut to meet upper estimate of requirements plus margin

Item and species group	Sawtimber			Growing stock		
	1952[3]	1975	2000	1952[3]	1975	2000
	Billion bd. ft.	Billion bd. ft.	Billion bd. ft.	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.
Net growth:						
Eastern hardwoods	19.1	22.6	12.2	7.1	8.7	7.9
Eastern softwoods	17.0	20.1	..	4.4	4.6	.6
Western species[1]	11.3	15.9	13.0	2.8	3.6	3.7
Total	47.4	58.6	25.2	14.3	16.9	12.2
Inventory:						
Eastern hardwoods	381.2	498.1	366.0	151.0	230.0	289.3
Eastern softwoods	241.9	291.7	..	74.2	82.3	7.3
Western species[1]	1,433.8	1,143.7	602.4	291.7	261.3	202.8
Total	2,056.9	1,933.5	968.4	516.9	573.6	499.4
Timber cut:[2]						
Eastern hardwoods	12.2	18.4	29.4	3.2	4.6	7.5
Eastern softwoods	14.1	18.1	33.2	3.7	4.6	7.6
Western species[1]	22.5	31.7	42.8	3.8	5.4	7.0
Total	48.8	68.2	105.4	10.7	14.6	22.1

1/ Coastal Alaska included.
2/ Includes margin for contingencies.
3/ Beginning of 1953 for inventory.

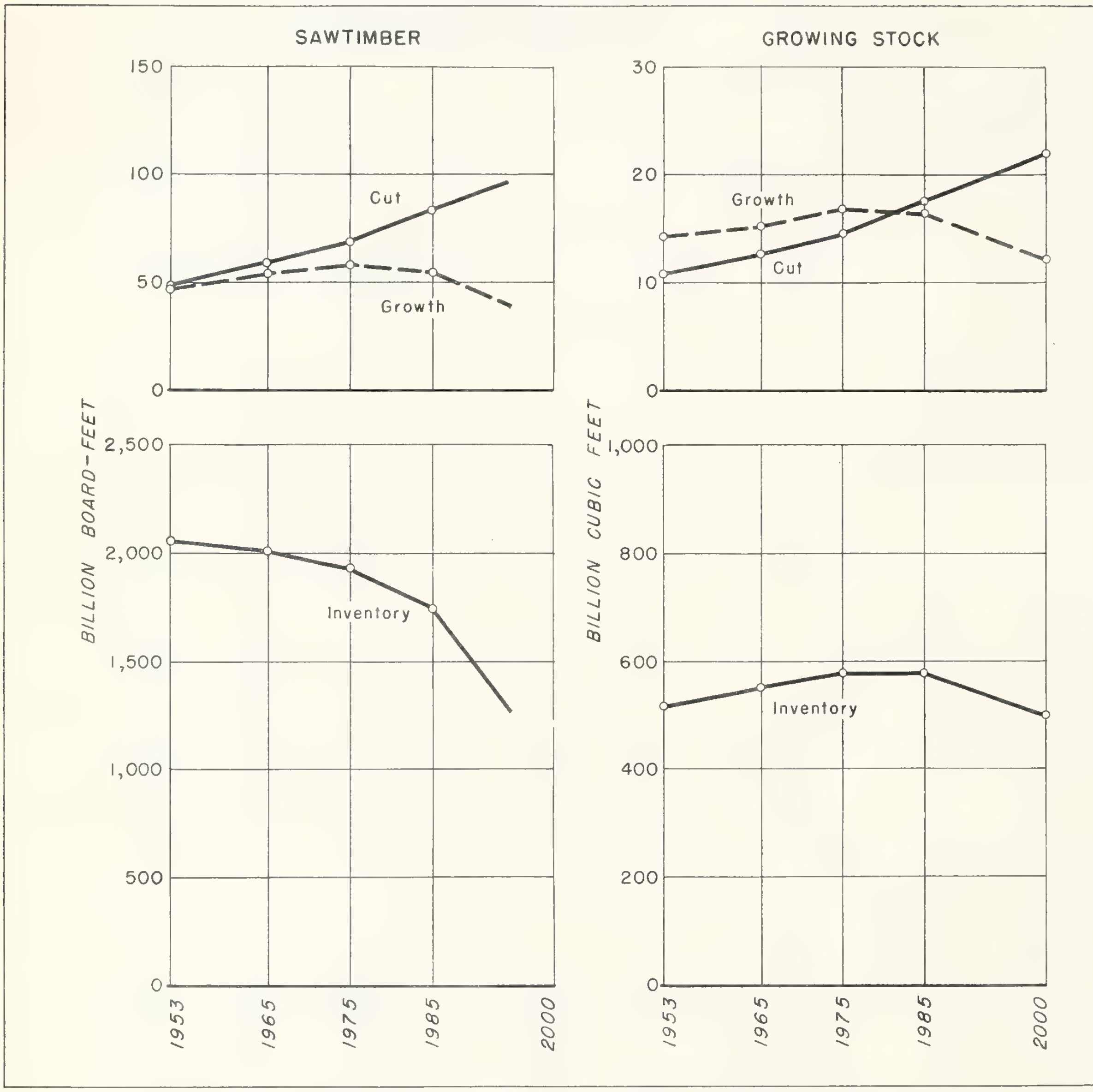


Fig. 8 - Assumed cut and resulting growth and inventory in upper projection, all species.

Growth of eastern softwood sawtimber between 1952 and 1975 would correspond closely with that shown in the lower projection. After 1975, however, the assumed cut would overtake sawtimber growth, and cause it to plummet after 1985 (fig. 7). Growth of eastern softwood growing stock would likewise turn down after 1975 and drop precipitiously after 1985.

For eastern hardwoods, growth of growing stock would turn down after 1975 but would not fall below cut before 2000. However, growth of hardwood sawtimber would fall rapidly below cut after 1980 (fig. 7). By 2000 it would be only about 40 percent of the upper level of potential demand with the margin.

These sharp reversals of growth trends are the result of inventory depletion under the heavier pattern of cutting assumed in the upper projection.

Inventory Depletion Would Preclude Carrying Upper Projection to 2000

Under the impact of the pattern of cut and margin assumed for the upper projection, sawtimber inventory would drop at an accelerating rate to less than half its present volume in 2000 (fig. 8). Inventory of growing stock, which is now building up, would turn sharply down after 1985. The indicated inventory decline is so great that it would not be possible to sustain the group of assumptions on which the projection is based until the end of the century. The developing shortage would send the price of timber products up; rising prices would check the projected increase in volume consumed. These things might also lead to much more intensive forestry than assumed in the projection and this would tend to sustain the timber supply. Each of these effects would run contrary to the assumptions of the projection. The impossibility of holding to the assumptions will become clearer as the impacts of the heavier cut required by this projection on the three major species groups are examined.

As might be expected, a large part of the sawtimber inventory decline would be in the West (table 10). But the drop of western sawtimber volume from 1,434 billion board feet to 602 billion carries far below the 1,057 billion minimum needed to sustain the upper estimate of needed growth (table 6). Clearly output of the western forests could not be raised to more than 40 billion board feet by 2000, as assumed in this projection, without seriously undermining their ability to continue to supply so large a share of a total national need of 105 billion board feet. Nevertheless, the allocation of cut to western species is proportionally no heavier than that required from eastern softwoods.

Under the pressure of a cut rising from 14 billion board feet in 1952 to 18 billion in 1975, and 33 billion in 2000, eastern softwood growing stock would theoretically be wiped out. The indicated deficit of 14 billion board feet in 2000 is the result of a 65 billion board-foot deficit in the South and a residual stand of 51 billion board feet in the North. The relatively small increase in cut prior to 1975 would permit some increase in timber volume up to that time in both North and South, but the more rapid increase in cut which would be required after 1975 would prove disastrous in the South.

Even for eastern hardwoods, the upper estimate of needed growth seems out of reach. Although the projection indicates that cubic volume of growing stock would continue to increase up to the year 2000, the rapid increase of sawtimber volume now in progress would be sharply reversed after 1985. All the gain made up to that time would be lost by 2000, when hardwood sawtimber volume would be less than half of the amount needed to sustain the upper estimate of needed hardwood growth.

The most striking feature of this projection is the theoretical disappearance of softwood growing stock from the South. Long before any such thing would actually happen, output would be curtailed and cut would be shifted elsewhere. But the projection indicates that the softwood forests of both North and West (not including Alaska) would themselves be suffering under the output already allocated to them. Alaska would be in a marginal position. Since no other section would be able safely to absorb any of the output allocated to the South, it is clear that total softwood output would be reduced. A further shift to hardwoods to maintain the national total would likewise be no solution, even if technologically feasible, because the projection shows hardwood sawtimber volume shrinking rapidly at the end of the century under the cut predicated for it.

Thus, the upper projection presents a tremendous challenge to American forestry. For only by widespread adoption of much more intensive forestry than envisaged at present will it be possible to increase timber cut enough to sustain the 1952 position of wood in the Nation's expanding economy after 1975 without serious depletion of growing stock.

To sustain an annual drain of 105 billion board feet, as contemplated in the upper projection, is not inherently beyond the productive capacity of the land. But meeting the potential demands of the expanding economy as they develop imposes a greater load on the presently unbalanced and nationally inadequate growing stock than it can stand. If output were to continue at present levels until growing stock in all sections could be brought into condition for optimum production, annual timber growth could eventually be raised to 105 billion board feet. But even under this assumption plus a greatly accelerated trend toward widespread application of intensive forestry, it is doubtful if this level of annual growth could be achieved by the end of the century.

THE OUTLOOK

LONG RANGE SOFTWOOD SUPPLY IS QUESTIONABLE

In this chapter, two estimates of future requirements have been translated into lower and upper estimates of needed timber growth. These estimates of needed growth serve to define the range of possible future demand up to the year 2000. In this framework, future supply possibilities have been analyzed by projecting net growth and timber inventory to the end of the century on the assumption that forestry would continue to progress at a rate indicated by recent trends.

The projections indicate that the Nation's future timber situation is more likely to be characterized by shortages of supply rather than by

surplus or inadequate demand. Population growth and increases in gross national product assure a substantial increase in demand. But whether annual timber growth can be correspondingly increased is a moot question.

Output of timber products, if properly distributed among the regions, could be expanded for some years without jeopardizing continued productivity of the Nation's forests. But continuing for more than 30 years, an output that would keep timber products as plentiful as at present in the expanding economy of the future, without much more intensive forestry than now seems likely, would disrupt the forest growing stock in all parts of the country. To sustain even the lower estimate of potential demand with a margin for contingencies--a level of demand that implies higher real prices for timber products--would require greater improvement and extension of good forest management than was assumed in continuation of recent trends.

The most critical situation is in softwoods. Softwood growth is increasing. In the East, it is currently in excess of timber cut. Nevertheless, the prospective increase in cut under even the lower projection would create a national deficit of 16 billion board feet in softwood growth-cut balance by 2000. The upper projection would turn softwood growth sharply downward after 1975, wiping out softwood growing stock in the South and seriously depleting it in the West.

For hardwoods, a supply problem does not become apparent until the end of the century, except as to quality. High quality hardwood timber is currently hard to find even at premium price in much of the country. Yet hardwoods, often of inferior quality, are rather generally increasing in the East, often at the expense of the more critical softwoods.

SOME FACTORS MAY ADD TO THE TIMBER SUPPLY

All in all, the analysis of supply possibilities challenges the Nation's best forestry effort in the years ahead. What the Nation can accomplish in timber growing will be the measure of how plentiful wood will be in the economy of the future.

But there are other factors which may make the task easier than the projections indicate.

One element of strength in the situation is the backlog of inventory in western forests not yet opened for operation or not yet operated at sustained yield capacity. How rapidly or slowly these forests are opened up and how well or poorly cutting in them is handled can make a substantial difference in future timber supply and annual growth. Maximum orderly output from these forests will relieve the pressure on other forests in the years immediately ahead and contribute most effectively to needed growth in the more distant future.

Another factor worth mentioning is the supply of timber on noncommercial forest lands and on lands not classed as forest. Timber cut from such lands does supply some of the demand locally and it may contribute more significantly as potential demand increases. Since neither the timber now on such lands nor the growth which takes place on them has been

included in the analyses of future supply possibilities, whatever they yield will serve to reduce the demand on the commercial lands. Greater use of cull trees might also relieve the pressure on growing stock.

Similarly, the timber of Interior Alaska constitutes a backlog which may become economically available if other sources of supply prove inadequate. Under such circumstances, imports from Canada may also increase more than assumed in the estimates of domestic requirements.

Still another factor to be emphasized is improvement in utilization, which makes the timber grown go further in meeting demands for timber products. The pattern of cut used in the projection already makes allowance for some progress in utilization. But with the technology of timber harvesting and wood use holding as much promise as it does, the projections may not have gone far enough in this direction.

The situation revealed by the projections may also be alleviated if the margin for contingencies included in the assumed drain were not needed. The margin allowed for 1975 amounted to 2.8 billion board feet, which is not excessive in the light of estimates that losses from catastrophes average about 2 billion board feet. It leaves less than 1 billion board feet annually for other unforeseen contingencies. For 2000, however, the margin amounts to 10.3 billion board feet. If all the margin is not needed, the lower projection would appear in a more favorable light. But the saving, however substantial it might be, would not be sufficient to change the nature of the challenge presented by the upper projection.

OTHER FACTORS MAY ACCENTUATE SUPPLY PROBLEMS

Not to be overlooked are a number of factors which may make the long-range demand more difficult to meet.

Fundamental is the possibility that the estimates of population and national productivity upon which the estimates of potential demand in 2000 were based may prove too low. The reality of this possibility lies in the fact that the population forecast was a median estimate and does not reflect the maximum potentialities of trends now in evidence. Similarly, the projection of gross national product was partly based on a conservative rate of increase in productivity of labor.

Another consideration which should not be ignored is the potential demand beyond 2000. The projections have not gone beyond the end of the century. Yet we have no basis to assume that the Nation's growth would culminate at that time. If national growth continues, the challenge to forestry is not likely to end when the level of growth needed in 2000 is achieved.

A third factor which may make the situation more difficult to meet is the acreage of forest land upon which increased productivity may be obtained. Other chapters have pointed out the difficulty of getting good forest practice on lands held by very small owners. True it is that holdings of 30 acres or less in size comprise only 6 percent of the commercial forest land, although they account for 50 percent of all

private forest land owners. Nevertheless, little can be expected from a certain percentage of the land. Furthermore, there will always be considerable variation in the intensity of forestry applied by different owners. Presumably such variations have been taken into account in the growth rates, mortality rates, and other factors involved in the projections. Nevertheless, it is difficult to be specific in accounting for a factor like this, and it is possible that the projection of recent trends in forestry could not be easily realized.

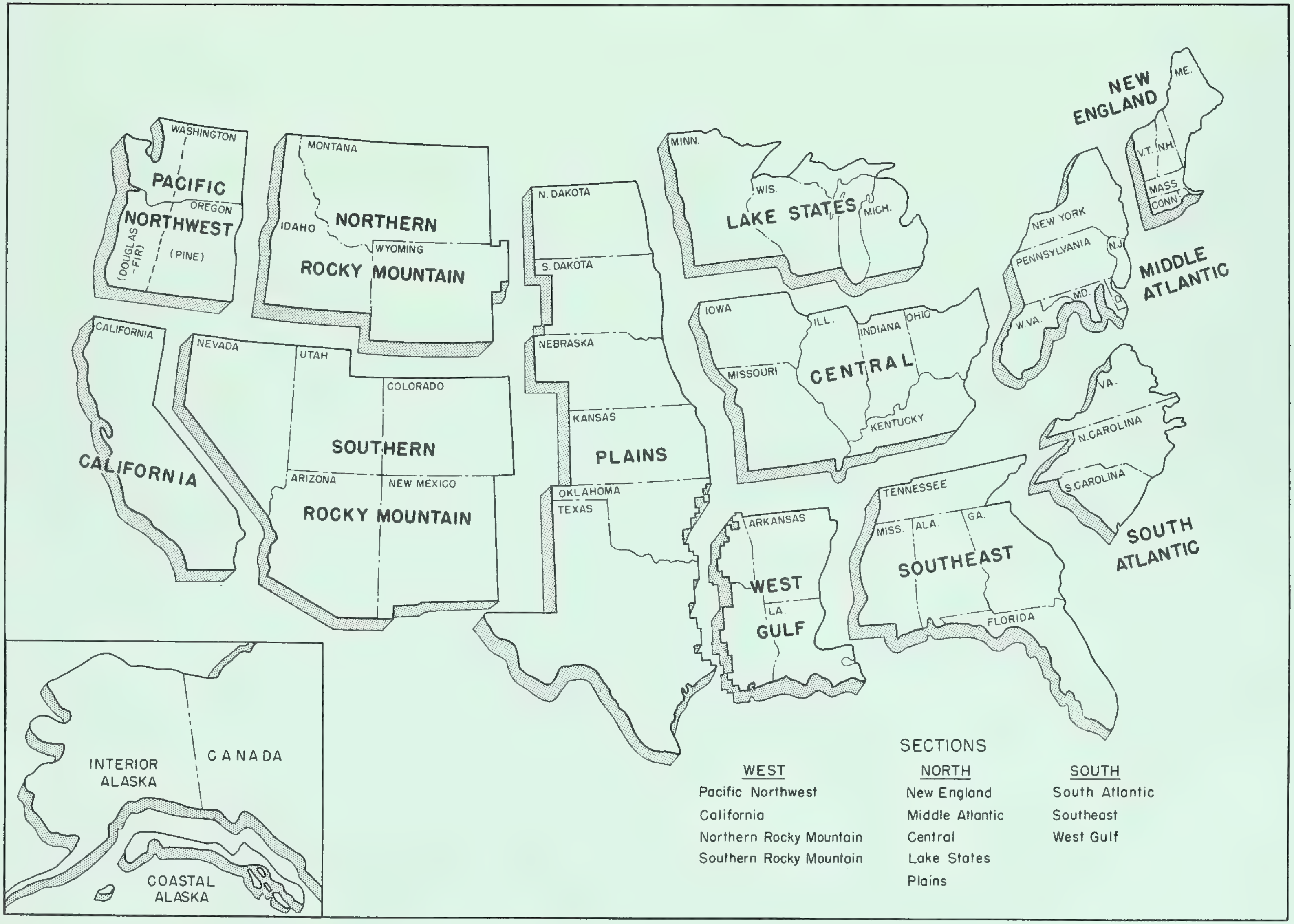
More important than this, however, is the possibility that the area available for timber production in the future will be less than at present and that this reduction has not been fully accounted for in the projections. On the one hand, the downward readjustment of the area devoted to crops and pastures and the accompanying reversion to forest is nearing completion. And, on the other hand, the area available for timber growing is being steadily reduced by urban and industrial development, by land needed for highways, power lines, and similar purposes, and by further setting aside of forest land for recreational and scenic purposes.

THE OUTLOOK FOR FORESTRY IS CHALLENGING

The final question to be considered is what this all means in opportunity and outlook for forestry. Does the outlook lend substance to the assumption upon which the projections were made that forestry would continue to progress at the rate indicated by recent trends? Is the outlook such as to encourage forest landowners to adopt better forest practices so as to increase the productivity of their holdings? Is it such as to justify resisting the temptation to overcut at present high prices and conserve or build up growing stock for future yields?

In the main, all these questions can be answered in the affirmative.

To sum it all up, the analysis of future possibilities in demand for and supply of commercial timber leads to one overwhelming conclusion. Now as never before the country needs more intensive forestry and more widespread management of forests for sustained yield at a high level of productivity. Idle and understocked land and unmanaged forests are portents of future problems. The ability of the forests to meet the raw material demands of a strong, healthy, and prosperous Nation in years to come will depend on how rapidly forestry effort is accelerated in the next decade or two and how skillfully we utilize the productive capacity of the land.



Regions and Sections used in the Timber Resource Review

TIMBER RESOURCE REVIEW

CHAPTER VIII
TIMBER RESOURCES OF NORTH AMERICA AND THE WORLD

(Preliminary Review Draft Subject To Revision)

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INDEX TO TIMBER RESOURCE REVIEW REPORTS AND APPENDIX MATERIAL

(Each Chapter and each Section, in the case of Chapters IV and IX, is a separate document)

CHAPTER VIII. T I M B E R R E S O U R C E S O F N O R T H A M E R I C A A N D T H E W O R L D

(Preliminary review draft subject to revision)

Interior Alaska

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Canada, Mexico, and the World

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September, 1955

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TIMBER RESOURCES OF NORTH AMERICA AND THE WORLD

INTRODUCTION

Any realistic appraisal of the future timber supply situation of the United States must consider the forest resources in Interior Alaska, Canada, Mexico and more remote parts of the world that might carry on timber trade with the United States. Accordingly this chapter will review briefly the timber resources of North America and the world emphasizing the relationship of those resources to comparable resources in the United States and to possible United States import and export opportunities. This discussion is oriented mainly with respect to the free world because trade barriers between the nations of the free world and the Communist nations must be faced. Until normal trade between these two groups is resumed the considerable supply of softwood timber in the U.S.S.R. and associated countries is largely unavailable to the free world. For present purposes it seems safer to consider the timber supplies of the free world alone, with reference to timber supplies in Communist countries mainly for comparative purposes. If, at a later date, Communist timber resources become freely available in international trade, the needs of some of the timber importing nations can be met more easily.

To understand the world timber supply situation it must also be recognized that the knowledge of the forest resource in only a few countries is based on soundly conceived, statistically reliable field surveys. In many countries, accounting for considerable timber volume, the only available data are estimates made by experienced technicians acquainted with the local conditions. An effort has been made to secure the best available resource information.

INTERIOR ALASKA'S TIMBER SITUATION

Future development of Alaska's vast Interior (fig. 1) is endangered by forest fires which have burned an average of over a million or more acres every year since 1940. Almost every acre in the Interior has been burned at one time or another, yet there is a forest resource of at least 180 billion board feet on 40 million acres of commercial forest land. Even under the reduced growth caused by fire, insects and diseases there is an estimated net yearly growth of almost four billion board feet. Alaskans now use only three-tenths of one percent of this, yet they import some $7 million worth of wood and wood products. The development of forest industries in the Interior would do much to reduce the import to a small fraction of its present quantity and would contribute to the industrial growth and economic development of the Territory. The forests under adequate protection are capable of supporting substantial forest industries, as do somewhat similar forests of southern Canada and northern Maine.

FORESTS COVER MORE THAN ONE-THIRD OF INTERIOR ALASKA

Alaska's interior forests cover almost 120 million acres, or 35 percent of the total land area. Another third, roughly, consists of grassland, brush, swamps and tundra, with a small fraction in agricultural crops. The balance is barren rock or ice and snow, largely at high elevations. The land area of Interior Alaska by major classes of land, is as follows:

	Area (thousand acres)	Area (percent)
Forest land:		
Commercial	40,000	12
Noncommercial	79,700	23
All forest land	119,700	35
Nonforest land:		
Agricultural cropland in use	10	..
Possible cropland, not used	3,850	1
Grassland	23,140	7
Brushland	23,000	7
Swamps and tundra	62,200	18
Barren, rocks, ice	99,000	29
All nonforest	211,200	62
Total land area	330,900	97
Water (rivers and lakes)	8,790	3
Total area Interior Alaska	339,690	100

As shown in figure 2, the forests extend to the Arctic tundra, the dense stands being largely confined to the lower slopes of the larger river valleys and their main tributaries. The more open woodlands, or sparse

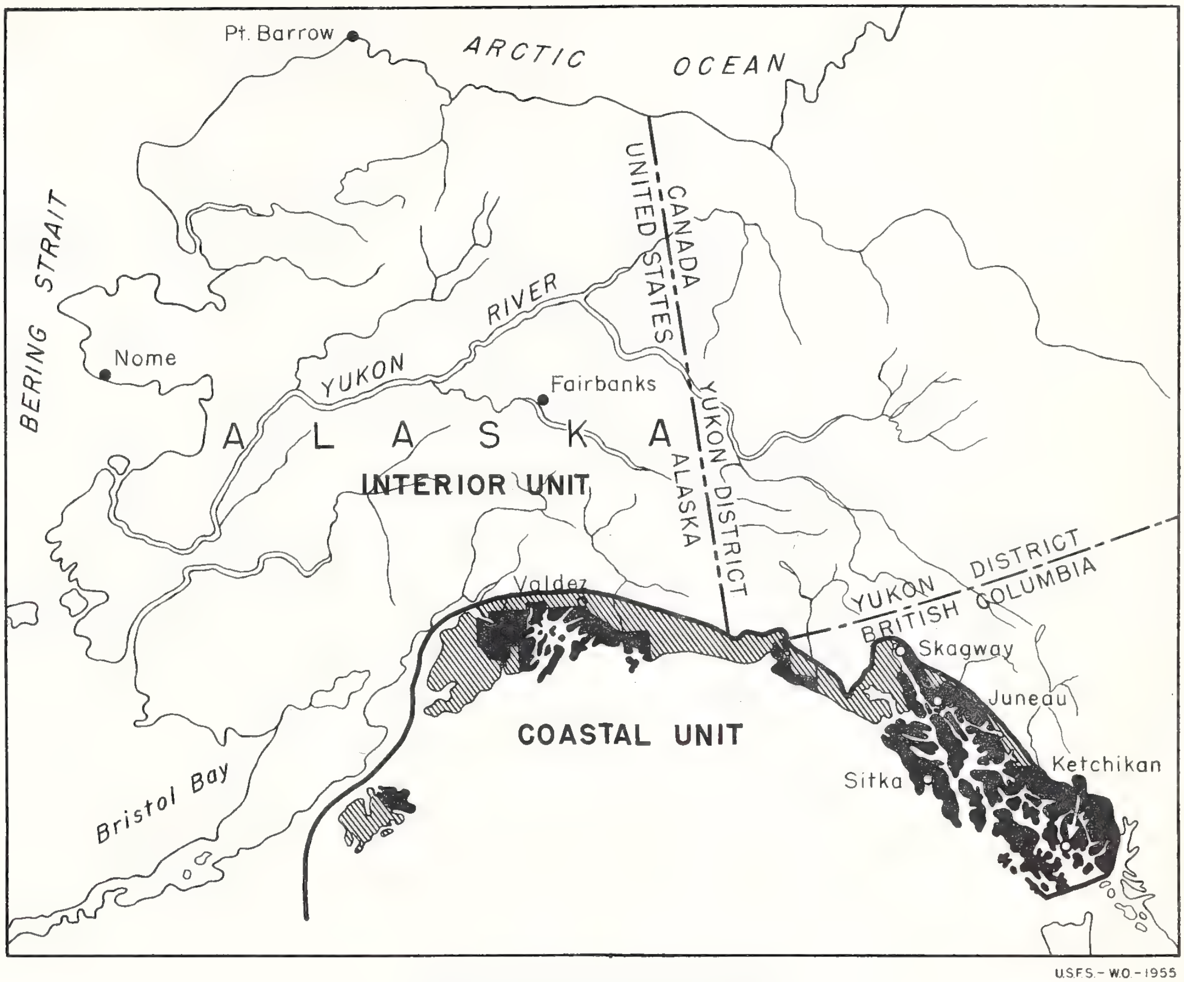

Fig. 1 - Forest Units of Alaska

FIGURE 2
FOREST REGIONS OF ALASKA
1949

forests of the same species (white spruce and birch) reach up the slopes to timber line and extend over the higher plateaus. Over 99 percent of the Interior, forested as well as nonforested, is under the jurisdiction of the U.S. Department of the Interior's Bureau of Land Management.

Forty Million Acres of Commercial Forest Land

Land not good enough for producing agricultural crops, but either producing, or capable of producing forest stands having 5 thousand board feet of timber in trees 11 inches and larger in diameter is considered as commercial forest land. Forty million acres of such land or an area almost as large as the commercial forest land area of the Lake States extends along the river valleys and lower slopes of these drainages. The sparse or open woodlands, presently considered noncommercial, cover almost 80 million acres. The principal forested regions include the following: The Copper River and its many large tributaries, the Matanuska River, the Susitna River and its tributaries, upper Cook Inlet and the Iliamna Lake--Lake Clark and Nushagak River sections, the Kuskokwim, Tanana and Yukon River regions. It is noteworthy that considerable areas of forest land, much of it commercial, occur north of the Arctic Circle, for example on the Porcupine River and its tributaries, the Chandalar, and the Upper Koyukuk Rivers. Tree Growth is known to occur well north of latitude 68°N on the south slopes of the Brooks Range and as far west as the Niukuk River, near Council, on the Seward Peninsula. This latter station is the westernmost occurrence of forest growth on the North American Continent.

Land other than that forested, comprising some 211 million acres or 62 percent of the total consists of 29 percent swamps and tundra, 47 percent barren mountain tops, 11 percent brushlands, 11 percent grass, and the balance, a mere two percent or 3.9 million acres is considered to be of possible agricultural value. As no land classification has been completed, there is a diversity of opinion as to the amount that could be called cropland.

In 1950, according to the Census of Agriculture, there were about 10,000 acres of cropland in farms in the Territory, but only 6,500 acres harvested. Agricultural land is almost nonexistent in the coastal area so that most of this cropland lies within the Interior. Of the 40 million acres of commercial forest land 14 million are in areas being used for producing lumber, houselogs and fuelwood. Much of the remaining 26 million acres is fairly accessible to rivers or other travel routes, but lies beyond the range of present use.

According to the estimate in the following tabulation, 95 percent of the commercial forest land is in public ownership; that is, it is either vacant, unreserved public domain, or controlled by the Government as a War or Navy Department reservation, a wildlife preserve, national park or monument.

	Commercial forest land area of Interior Alaska, 1953	
	(thousand acres)	(percent)
Ownership:		
Public	37,870	94.7
Institutions:		
Religious	27	.1
University and Indian schools	103	.2
Total	130	.3
Private:		
Industrial (mining corporations canneries, etc.)	500	1.3
Farms (includes homesteads)	1,000	2.5
Small tracts, public service sites, homesites, etc.	500	1.2
Total	2,000	5.0
All ownerships	40,000	100.0

About 40,000 acres of this is reserved under authority of the Department of the Interior to provide an assured and stable supply of products for certain settlements.

Institutional ownership represents less than 1 percent of the total. The portion now held by religious institutions stems from original grants to them by the former owners of Alaska--Russia.

Private ownership of commercial forest land by individuals and corporations amounts to about 5 percent of the total. Half of this area is found on farms and homesteads. As shown in the following tabulation, private land is held primarily in small ownerships, 80 percent of the total being in tracts of 1,000 acres or less.

	Private commercial forest land area in Interior Alaska, 1953	
	(thousand acres)	(percent)
Ownership size class:		
Less than 1 acre	5	0.2
1-5 acres	20	1.0
5-100 acres	475	23.8
100-1,000 acres	1,100	55.0
More than 1,000 acres	400	20.0
Total	2,000	100.0

The Forests are Chiefly White Spruce and Birch

Fortunately for Alaska much of the forest land returns after fire to commercial tree species unless it has been so severely burned as to prevent regeneration to trees. White spruce and white birch, also natives of northern Maine, the Lake States and Canada, in their westward extension to Alaska are not accompanied by such weed species as gray birch or red maple. Seen from the air the forest and other vegetation cover appears as a complex mosaic of types. In general, the forest occupies the valleys, often appearing as belts which follow the meanders of the streams, and the lower slopes and low bench-lands. Throughout most of the region timberline is comparatively low, between 2,000 and 3,000 feet elevation.

The complexity of the vegetation pattern is, in large measure, the result of fire. Only when the influence of past fires is appreciated can one begin to account for the seemingly haphazard distribution of vegetation types. The sharp boundaries between stands of quaking aspen or Alaskan white birch and white spruce are then recognized as the edges of burns. Isolated stands of a few acres of white spruce, the upland stringers and even the scattered trees of white spruce, may then be demonstrated to represent remnants or relics of former extensive stands that have been destroyed by fire. Some areas now treeless, on close examination, prove to have formerly supported full forest stands which were destroyed by repeated burning.

Another influence that contributes to the diversity of vegetation cover is the occurrence, in somewhat complicated pattern, of permanently frozen ground. This phenomenon frequently results in poor soil drainage with the attendant evils of poor soil aeration, restricted root space and low soil temperatures. Within the Alaskan Interior, either greatly impeded drainage (whether associated with permanently frozen ground or not) or very excessive drainage lead to outstandingly poor sites for tree growth.

Sharp boundaries between vegetation types are most frequently caused by fire whereas those caused by topography and associated influence are apt to be diffuse.

No reliable information is available as to the relative areas of individual softwoods (white spruce, black spruce) or of hardwood species (white birch, cottonwood and aspen). It has been roughly estimated that about 55 percent of the commercial forest land has coniferous cover, 17 percent has a cover of broadleaved trees and the balance--28 percent--is a mixture of broadleaved species and conifers, having a ratio of 60 percent softwoods and 40 percent hardwoods. The 40 million acres, when broken down in this way, are composed of 29 million acres of softwoods and 11 million acres of hardwoods.

Following are the recognized forest types of Interior Alaska. Their characteristics are somewhat at variance with similar types further east. The white spruce and the white birch types and their mixtures comprise the bulk of the commercial forest on the better sites. Aspen and tacamahac poplar (balsam poplar) also form merchantable stands.

Black spruce usually becomes of merchantable size only when it invades better drained areas on uplands.

1. <u>White spruce is the climax forest community</u> on upland areas of the Interior. The essentially pure stands are broken by areas of white birch or aspen or types transitional between these and pure spruce. A stand may be even-aged or many-aged, depending on whether it started as a seedling stand or by gradual entry into a paper birch or aspen overstory. Average maximum heights at maturity, (about 160 years) are 85-100 feet, and average maximum diameters 24-28 inches with individuals of much larger size.

2. <u>The white birch type follows fire,</u> but later white spruce enters the stand to form a mixed type. Fires perpetuate the birch and reduce the spruce representation. At 100 years or so birch declines as decay increases and the stand moves gradually toward the climax. In the essentially pure stands, birch at maturity seldom exceeds 80 feet in height or 18-20 inches in diameter.

3. <u>Quaking aspen also follows fire</u> and in the absence of fire or cutting is gradually replaced by white spruce. Fire maintains aspen as it reproduces from both root suckers and seed. After 50 or 60 years decay opens up the stand. Average maximum heights and diameters are 60 feet and 10 inches, respectively.

4. <u>White spruce-white birch and white spruce-aspen are transition types.</u> With absence of fire, spruce gradually invades the white birch type or the aspen type to become a mixture, with spruce dominant after maturity of the birch or aspen. When mixtures are about even, mature heights are: spruce 65-75 feet; birch 60-70 feet. Average maximum diameters: spruce 13 inches; birch 15 inches.

5. <u>The tacamahac poplar type often maintains itself,</u> especially if the streams along which it occurs are subject to periodic overflow. Heights of 70 feet and diameters of 36 inches are common. White spruce sometimes enters the stand and gains dominance. Where this happens it will eventually replace the poplar. Fires are uncommon in poplar stands. The species has a thick bark which makes it more fire resistant than other Alaskan forest trees and reduces damage from many of the few fires which do occur. Following destructive fires it regenerates much as aspen does.

6. <u>The black spruce type also maintains itself,</u> as it commonly occurs where drainage is poor and the permafrost table is close to the surface. On such sites it seldom becomes of merchantable size. Competition from other species is light on the poorly drained habitat and black spruce is considered a physiographic climax on these sites. Stand densities are high; even at 100 years there may be 2,000-3,000 trees per acre one inch in diameter and larger. Average maximum heights in mature stands seldom exceed 45 feet and diameters 8-9 inches. Reproduction is by layering and seedling growth. Fires are intense; the density and small size of the trees favor crown fires.

TIMBER VOLUME IS SUBSTANTIAL AND NET GROWTH IS GOOD IN SPITE OF FIRE

The commercial forests of the Interior are not stunted Arctic stands. Volumes of stands unburned since their beginning are comparable to those of southern Ontario or northern Maine. Occasional spruce stands of 15 thousand board feet per acre are found. Trees 24 to 30 inches in diameter at not over 200 years have been found north of the Arctic Circle. Mortality is the unknown factor, spread over the losses due to fire, insects, diseases and climatic damage. Rates of growth, yields at various ages, and location of the best stands all await study. Cutting is pretty much confined to the spruce type, but spruce-birch has almost equally high volumes. Pure birch, or birch with spruce, in the understory, form dense stands over large areas and probably run as high as 8 thousand board feet to the acre. Amount or kind of defect taking the largest toll is unknown. There is an immense resource in spire of great losses due to fire, insects and disease.

Thirty-two Billion Cubic Feet Awaiting Use

The Interior stands are in various stages of recovery following fires, some just reproducing, other unburned since their beginning over 100 years ago. It has been estimated that the average volume of such stands over the range of conditions found would be only 800 cubic feet or 4,500 board feet per acre.

The total estimated volume of 180 billion board feet on the 40 million acres of commercial forest land can be roughly separated into 28 percent hardwoods (mostly birch) and 72 percent softwoods (mostly spruce):

	Area (thousand acres)	Sawtimber (thousand bd. ft.)	Growing stock (thousand cu. ft.)
Softwoods	28,932	130,194,000	23,145,600
Hardwoods	11,068	49,806,000	8,854,400
Total	40,000	180,000,000	32,000,000

Eventually surveys may show the true volume to be as much as 350 billion board feet on both commercial and noncommercial forest land.

The estimate of 32 billion cubic feet including 180 billion board feet, on commercial forest land constitutes an immense resource that is not being used and is suffering constant inroads by fire and other destructive agents.

Net Growth Could be much Greater

With adequate fire protection to bring a larger part of the estimated 40 million acres to maturity, to allow severely burned areas to return gradually to forest and to maintain all stands in a growing condition, growth could be greatly increased. Fires wipe out not only stands of commercial size, but immature stands which may take 10 years to reproduce.

It has been estimated that mature 160 year-old stands on good sites will contain about 3,900 cubic feet per acre of growing stock and 15,500 board feet of sawtimber. The mean annual net increment indicated by such stands of 24 cubic feet and 97 board feet per acre, totals nearly one billion cubic feet of growth annually including 3.9 billion board feet, as shown in the following tabulation:

	Area (thousand acres)	Total net growth: Sawtimber (thousand bd.ft.)	Total net growth: Growing stock (thousand cu.ft.)
Softwoods	28,932	2,806,404	694,368
Hardwoods	11,068	1,073,596	265,362
Total	40,000	3,880,000	959,730

Mortality Losses are High

Losses caused by a combination of fire, disease, insects and climatic factors have been roughly estimated at 2 billion board feet per year on the commercial forest land. What part of this is caused directly by fire is unknown, but is estimated at 50 percent of the total.

It is reasonable to assume that the proportion of mortality due to insects, diseases and other factors should be less in Alaska than in Canada where stands are more mature. Since, practically all of the Interior has been burned at least once, stands are young and subject to less damage by insects, disease and windthrow. The total impact of fire on future volumes due to wiping out young stands would be much greater.

Fires may be anticipating some losses by insects and diseases and if more stands reached mature age under better protection, the losses due to such factors might be greater. What part of the estimated mortality is caused by insects and diseases separately cannot be estimated on any practical basis.

During the past three years rough surveys of existing forest insects and diseases have been made annually. Before that, only occasional trips into the Interior were made by Forest entomoligists and pathologists. Of the insects, Dendroctinus borealis has been very destructive of white spruce and during 1949 and 1950 much of the timber between Anchorage and Palmer, 40 miles north, was badly damaged. Many insects have been identified as common to the tree species of Interior Alaska and many diseases also have been found. Losses due to wind and animals also doubtless occur. However, no quantitative data exist upon which to base individual estimates of the mortality and growth losses due to these destructive agencies.

PROTECTION IS DIFFICULT IN A FRONTIER COUNTRY

In the more inhabited areas, fire control is attempted. In remote areas little can be done as yet. Fire protection began in 1939 with

the organization of the Alaskan Fire Control Service, under the General Land Office. Prior to that from five to eight million acres were burned each year. With very limited funds this Service succeeded in reducing the annual burn from 4.5 million acres in 1940 to 117 thousand acres in 1945, but this was partly due to cessation of normal pursuits such as mining and trapping during the war years. With a resumption of these activities following 1945 there was a sharp increase in fire risk, the annual burn rising to 1.5 million acres in 1946 and 1947.

In 1947 the work of the General Land Office was assumed by the Bureau of Land Management. Subsequent efforts to reduce the annual burn were made in the face of an increase in population of 150 percent, an increase in road mileage of 71 percent from 1940 to 1952; and an increase in car licenses of 269 percent between 1947 and 1952.

Areas burned during the past 15 years were as follows:

Year	Area burned (thousand acres)	Year	Area burned (thousand acres)
1940	4,500	1948	35
1941	3,655	1949	18
1942	453	1950	2,064
1943	667	1951	222
1944	111	1952	75
1945	117	1953	473
1946	1,439	1954	1,431
1947	1,432		

Accent Must be on Fire Protection

After 10 years of fire control effort the Territorial Fire Control Act of 1949 was passed. This establishes a fire season from April 30 to September 30, inclusive and provides for additional periods when conditions warrant. The Governor, by proclamation, may prohibit setting of fires, smoking, entry or other use in designated areas. The act also includes other provisions for prevention, suppression and control and imposes civil and criminal liability for violations.

Acquisition of evidence against violators of fire laws is limited and difficult due to the immense area, much of it remote, limited personnel and poor transportation. Effort is being made by the Bureau of Land Management to supplement public education on fire problems with timely prosecution proceedings.

Three-fourths of the Fires are Caused by Man

In spite of the low population, at least 75 percent of the fires are caused by man, many in remote parts of the Interior where control is next to impossible. Records collected during the years of protection effort show the causes of forest or range fires to be as follows:

	Percent
Camp fires	27
Debris burners	24
Lightning	17
Smokers	16
Incendiary	3
Railroad	2
Miscellaneous	11

Education is needed

In the face of public indifference the present fire control organization is inadequate to hold the annual burn down to a reasonable standard. Alaskans, as well as tourists, defense workers and members of the Armed Forces serving in the Interior must be informed of the devastating effects of fire on the forest and range resource, as well as the damage to water, and soil and many forms of wildlife. The fire risk is annually becoming more acute due to the increasing population, greater tourist activity and extended road system.

There is great need for fire research to develop a danger rating system applicable to the Interior. The combination of fuel types, low precipitation and humidity, high winds and high temperatures coupled with long hours of summer sunshine probably create as severe fire danger as exists anywhere on the North American Continent.

LESS THAN HALF OF ONE PERCENT OF THE NET GROWTH IS USED

With an annual net growth of almost 4 billion board feet in the Interior only about 12 million board feet are cut. Yet lumber and lumber products are imported.

No forest products are exported

Industries based on Alaska's Interior forest products are almost nonexistant; certainly not of a size for export. The forests make little or no contribution to the Territorial industrial economy, being used only for rough lumber, house logs and fuel. Some 66 small sawmills, mostly portable, produce from 8 million to occasionally 20 million feet of rough lumber in a year. The annual rated capacity of them all is about 45 million feet but such mills seldom operate at capacity.

Local requirements are not great

Present requirements are difficult to determine as imports are unknown. For all of Alaska in 1947 there were $7 million worth of forest products imported. How much went to the Interior is unknown and since 1947 there are no records of imports except from foreign countries. With a population, according to the 1950 census, of perhaps 80,000 people in the Interior of Alaska and an estimated civilian per capita use of 150 board feet, the demand would be only 12 million.

It has been estimated, however, that the population of such centers as Anchorage and Fairbanks has increased so much that the Interior's present population (1954) may be nearer 130,000 which would call for 19.5 million board feet for civilian use. Construction and maintenance by the Armed Forces in the Interior would probably increase this to 30 or 40 million board feet.

Even if existing mills improved their manufacturing processes and increased production to capacity the entire needs of the Interior would not be met. Specialty products and special grades would continue to come from the outside.

THE FOREST ECONOMY IS IN A PIONEER STAGE

Present conditions obtaining in the Interior are probably typical of the pioneer stage of development. As in the early days in the States there are vast areas undeveloped, a great excess of growth over drain, high losses due to fire, insects and disease with a rapidly expanding population, which so far has been associated with defense activities. The construction of the Government railroad and automobile roads to connect with the Alcan Highway through Canada to the States has resulted in great belts of burned-over country. One has to fly off the routes of ground travel to see that there are large areas of timber of a size suitable for the manufacture of forest products.

Forest Industries are Needed

In appraising the situation--the immense supply in comparison to an almost total lack of use--it seems evident that improving local milling standards or starting new small wood-working shops is only part of the answer. The development of large wood-using industries is needed to utilize the birch and spruce where it is presently accessible. This will encourage development of less accessible areas. Small sideline industries would feed on the cheaper supply of manufacturing material thus made available.

Birch stands of good quality and volume equal to or greater than in the northern Lake States or New England are available and many are accessible. The great areas of spruce, spruce-birch, aspen and cottonwood could supply pulp mills, as in the Northeast.

General unfamiliarity with the timber resource of Interior Alaska and the lumber markets, as well as with the industry in general, has resulted in an unfavorable climate for industrial development. The lack of experienced loggers and mill operators in the Territory coupled with the customary operation of mills as a sideline rather than as a full-time business has failed to develop confidence. It has also failed to develop a product which inspires pride on the part of the operator and satisfaction on the part of the consumer.

The domestic problem is one of development of forest products industries to meet local needs, protection to reduce the risks to invested capital, adequate methods of financing and "know-how".

Of greater importance for the future is the significance of this resource as a reserve available to meet increased requirements originating beyond the borders of the Territory. The great growth of world population, shared by the United States, indicates an increasing requirement for forest products, particularly of softwoods. The marked trend toward increasing pulp production, for which Alaskan species are well suited, and the need for additional supplies is rapidly expanding the boundaries of economic accessibility. Forest industries are already moving northward in Canada especially in British Columbia and along the Pacific Coast to Southeastern Alaska. Mineral and power developments also share this trend. The need for forest products from Alaska's Interior lies in the future, but current trends indicate that the proximity of this need leaves no room for further public complacency regarding the present losses suffered by this resource.

CANADA'S TIMBER SITUATION

Canada's forest resources are of great importance to the United States. Most of Canada's forests are of species and timber size-classes that are peculiarly adapted to pulp and paper making. From these forests the United States imports three-fourths of the newsprint paper it uses and considerable quantities of wood pulp, pulpwood, and some lumber. The forests of large-size, virgin timber in British Columbia also supply the United States with substantial quantities of high-quality softwood lumber.

FORESTS COVER MORE THAN TWO-FIFTHS OF CANADA

Canadian forests cover 951 million acres out of a total of 2.2 billion acres (exclusive of Labrador). The comparable figures for the Continental United States are 648 million acres of forest land and 1.9 billion acres of total land area. The Canadian forests grade from readily accessible commercial forests, in the belt adjacent to the southern border, to completely inaccessible, sparse, scattered, noncommercial forest in the cold, windswept, northern tundras (fig. 3). Excluding the Yukon and Northwest Territories, 60 percent of the land area is forested; more than 80 percent of the total forest area is in the 10 Provinces (table 1).

The area of commercial forest land is estimated at 529 million acres (table 2). The heaviest concentration of commercial forest land occurs in the Maritime Provinces and in Quebec and Ontario; in each of these, commercial forest accounts for approximately three-fourths of the forest land area. Softwood species predominate on 63 percent of Canada's commercial forest area, hardwoods on 12 percent and a mixture of the two on the remaining 25 percent.

The noncommercial forest is usually stunted, sparsely stocked and characterized by species that can endure swamp and tundra-fringe conditions. These noncommercial forest lands are principally valuable for watershed protection, and for food and shelter for wildlife.

Of the commercial forest area, 370 million acres are accessible, i.e., are economically operable under present conditions. The remainder will probably become accessible as transportation systems are extended, as prices rise and as wood markets expand. The greatest concentration of accessible forest is in the Maritime Provinces, Quebec, Ontario and British Columbia (fig. 4).

Most Forests are Publicly Owned

Approximately 93 percent of the total forest area of Canada is publicly owned, i.e., is in the possession of the Crown; the remaining 7 percent is privately owned (fig. 5). The corresponding percentages for commercial forest land are 88 and 12 respectively. This is in striking contrast to the United States where 74 percent of the commercial forest area is privately owned. In Canada there has been little effort to move Crown land into private ownership. Rather, the policy has been to retain

Fig 3
FOREST CLASSIFICATION OF CANADA
SOUTH OF LATITUDE 75°

Table 1.--Land classification by region, Canada[1], 1953

Region	Land area: Total	Land area: Forest	Land area: Non forest	Relation of forest land to total forest land	Total land forested
	Million acres	Million acres	Million acres	Percent	Percent
Maritime Provinces[2]	56	38	18	4	68
Quebec	335	221	114	23	66
Ontario	223	143	80	15	64
Prairie Provinces[3]	441	214	227	22	48
British Columbia	230	159	71	17	69
Yukon and Northwest Territories	933	176	757	19	19
Total	2,218	951	1,267	100	43

1/ Exclusive of Labrador.
2/ Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick.
3/ Manitoba, Saskatchewan and Alberta.

Source: Canada Dept. of North. Affairs and Natl. Resources (formerly Dept Resources and Devlpmt.), Forestry Branch. Bul. 106. Amend. 1954.

Table 2.--Commercial and noncommercial forest land area by region, Canada[1], 1953

Region	Total	Commercial[2] Total	Commercial[2] In region	Commercial[2] Accessible	Relation to total forest area	Noncommercial
	Million acres	Million acres	Percent	Million acres	Percent	Million acres
Maritime Provinces[3]	38	29	6	29	76	9
Quebec	221	161	30	123	73	60
Ontario	143	102	19	83	71	41
Prairie Provinces[4]	214	110	21	64	51	104
British Columbia	159	79	15	55	50	80
Yukon and Northwest Territories	176	48	9	16	27	128
Total	951	529	100	370	56	422

1/ Exclusive of Labrador.
2/ Forest lands physically capable of producing crops of usable wood that are economically exploitable now or prospectively.
3/ Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick.
4/ Manitoba, Saskatchewan and Alberta.

Source: Canada Dept. of North. Affairs and Natl. Resources (formerly Dept. Resources and Devlpmt.), Forestry Branch. Bul. 106. Amend. 1954.

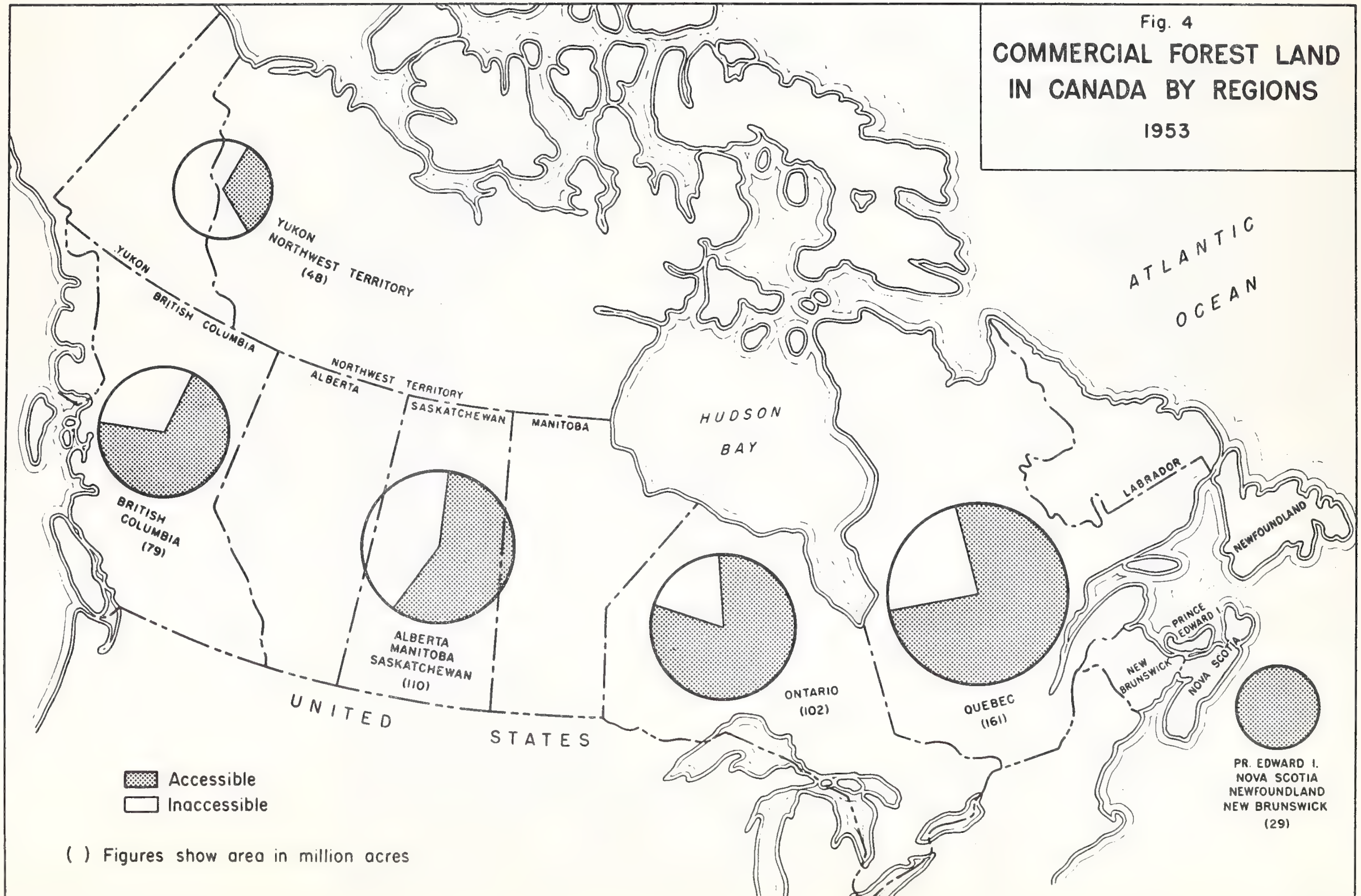

Fig. 4
COMMERCIAL FOREST LAND
IN CANADA BY REGIONS
1953

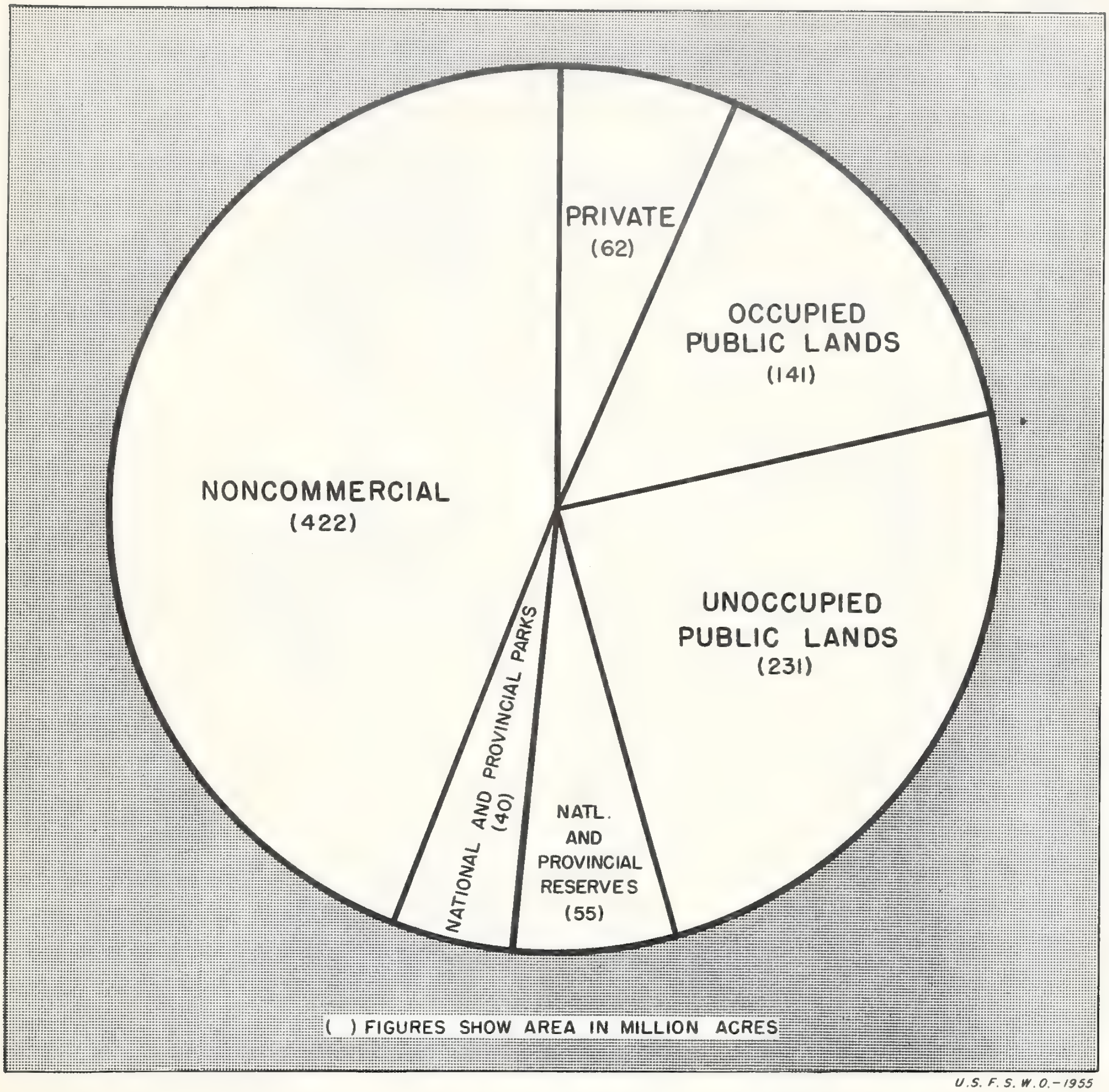

Fig. 5-Forest land in Canada by classes, 1953

title to forest land in the Federal Government or to transfer it to one or another of the Provincial Governments. Title to most of the public land in the provinces rests with the Provincial Governments.

The National and Provincial Governments have reserved approximately 95 million acres for special purposes. Some 40 million acres have been set aside as national and provincial parks, primarily for recreational use. On these areas timber is definitely not available for commercial cutting operations. Some 48 million acres are in provincial forest reserves, roughly comparable to national forests in the United States. On these, commercial cutting under certain regulations is permitted. An additional seven million acres are in military, Indian and other reserves.

Approximately 141 million acres of Crown forest lands, administered either by the Federal or Provincial Government, are occupied, i.e., have been leased or licensed or otherwise contracted for by private timber operators1/. Of this total, 117 million acres are held as pulpwood licenses. In Quebec, Ontario, New Foundland and Nova Scotia, pulpwood licenses account for about 90 percent of leased and licensed land. Elsewhere, the sawtimber licenses become more important and, for the nation, account for 21 million acres. The remaining 3 million acres are covered by sales of timber and other types of permits.

Some 62 million acres are privately owned timberland, of which 39 million acres are held by nonfarm owners and 23 million acres are in farm woodlots. These woodlots, ranging in area from 3 to 200 acres or even more, contain some of the most accessible timber in Canada. Some 60 percent of the farm woodlot area is in eastern Canada, where because of more favorable climatic and soil conditions it is generally rather productive.

Subtracting the area of occupied Crown forest, national and provincial parks and reserves, and private forest land from the commercial forest area, it can be derived that 231 million acres of commercial Crown forest land is unoccupied and awaiting license or lease. Some of this, of course, is not readily accessible.

Although it is conceivable that some of the 422 million acres of noncommercial forest land may, with the opening up of transportation systems, become commercial, most of the area will probably remain noncommercial.

1/ It is likely that scattered portions of the areas covered by leases and licenses may actually be noncommercial. No data regarding the size of this noncommercial area are available. Estimates as high as 25 percent have been made.

TIMBER VOLUME IS CHIEFLY SOFTWOOD

The timber volume on the commercial forest area is roughly estimated to be 397 billion cubic feet [2] including 782 billion board feet [3] or an average of 750 cubic feet and 1,485 board feet per acre (tables 3, 4, and 5 and fig. 6). This contrasts with an average of approximately 1,000 cubic feet and 4,100 board feet per acre for the United States. Of the total cubic volume, 61 percent is spruce, balsam fir and hemlock, which are prime pulping species. An additional 22 percent is pine, cedar, Douglas-fir, and other softwoods. Only 17 percent is hardwood, chiefly poplar (aspen) and white birch.

It is roughly estimated that 70 percent of the cubic-foot volume and 75 percent of the board-foot volume is found on areas now considered to be accessible. Of the accessible board foot volume, 70 percent is found in British Columbia (table 6). In this Province is concentrated the large-size Douglas-fir, hemlock and cedar timber. Current high quality lumber imports into the United States are largely dependent upon this resource. Viewed from another angle, this concentration of sawtimber in British Columbia indicates that elsewhere trees of smaller size predominate. Canada's forest resource, therefore, both as to species composition and size class of timber, is admirably suited to support an extensive and highly developed pulp and paper industry.

2/ In trees 4 inches and larger in diameter at breast height.

3/ In trees 10 inches and larger in diameter at breast height. It is possible that the timber-volume estimate may be conservative. Modern sampling surveys have covered only about one-fourth to one-third of the commercial forest area, and as surveys progress the reported timber volume has steadily increased.

Table 3.--Volume of merchantable timber[1] on commercial forest land by species and accessibility class, Canada, 1953

Species	Total		On accessible forest land		On inaccessible forest land	
	Million cu. ft.	Per-cent	Million cu. ft.	Per-cent	Million cu. ft.	Per-cent
Softwood:						
Spruce	150,231	38	99,861	36	50,370	41
Jack and lodge-pole pine	45,583	11	29,292	11	16,291	13
Balsam fir	62,106	16	40,510	15	21,596	18
Hemlock	27,811	7	19,520	7	8,291	7
Cedar	20,094	5	14,584	5	5,510	4
Douglas-fir	15,198	4	10,364	4	4,834	4
Other softwood	6,803	2	5,824	2	979	1
Total	327,826	83	219,955	80	107,871	88
Hardwood:						
Poplar (aspen)	37,482	9	27,276	10	10,206	9
White birch	21,663	5	17,892	7	3,771	3
Yellow birch	3,856	1	3,856	1	..	..
Maple	3,290	1	3,290	1	..	..
Other hardwood	3,196	1	2,999	1	197	..
Total	69,487	17	55,313	20	14,174	12
All species	397,313	100	275,268	100	122,045	100

1/ All trees 4 inches d.b.h. and over.

Source: Canada Dept. North. Affairs and Natl. Resources (formerly Dept. Resources and Devlpmt.), Forestry Branch. Bul. 106. Amend. 1954.

Table 4.--Volume of sawtimber[1] on commercial forest land by species and accessibility class, Canada, 1953

Species	Total		On accessible forest land		On inaccessible forest land	
	Million bd. ft.	Percent	Million bd. ft.	Percent	Million bd. ft.	Percent
Softwood:						
Spruce	231,010	29	173,285	30	57,725	29
Jack and lodgepole pine	59,253	8	45,613	8	13,640	7
Balsam fir	117,431	15	85,316	15	32,115	16
Hemlock	133,038	17	94,218	16	38,820	20
Cedar	92,032	12	65,557	11	26,475	13
Douglas-fir	70,978	9	49,608	8	21,370	11
Other softwood	20,143	3	17,268	3	2,875	1
Total	723,885	93	530,865	91	193,020	97
Hardwood:						
Poplar (aspen)	33,000	4	28,265	5	4,735	2
White birch	9,938)		9,353)		585)	
Yellow birch	5,710)	3	5,710)	4	..)	1
Maple	4,284)		4,284)		..)	
Other hardwood	5,180)		4,195)		985)	
Total	58,112	7	51,807	9	6,305	3
All species	781,997	100	582,672	100	199,325	100

1/ All trees 10 inches d.b.h. and over

Source: Canada Dept. North. Affairs and Natl. Resources (formerly Dept. Resources and Devlpmt.), Forestry Branch. Bul. 106. Amend. 1954.

Table 5.--Volume of merchantable timber[1] on accessible forest land by region, Canada, 1953

Region	Total		Softwood		Hardwood	
	Million cu. ft.	Per-cent	Million cu. ft.	Per-cent	Million cu. ft.	Per-cent
Maritime Provinces[2]	16,019	6	12,437	6	3,582	7
Quebec	63,701	23	45,928	21	17,773	32
Ontario	74,151	27	54,589	25	19,562	35
Prairie Provinces[3]	24,882	9	13,875	6	11,007	20
British Columbia	89,322	32	88,247	40	1,075	2
Yukon and Northwest Territories	7,193	3	4,879	2	2,314	4
Total	275,268	100	219,955	100	55,313	100

1/ All trees 4 inches d.b.h. and over on accessible forest area.
2/ Newfoundland, Prince Edward Island, Nova Scotia, and New Brunswick.
3/ Manitoba, Saskatchewan and Alberta.

Source: Canada Dept. North. Affairs and Natl. Resources (formerly Dept. Resources and Devlpmt.), Forestry Branch. Bul. 106. Amend 1954.

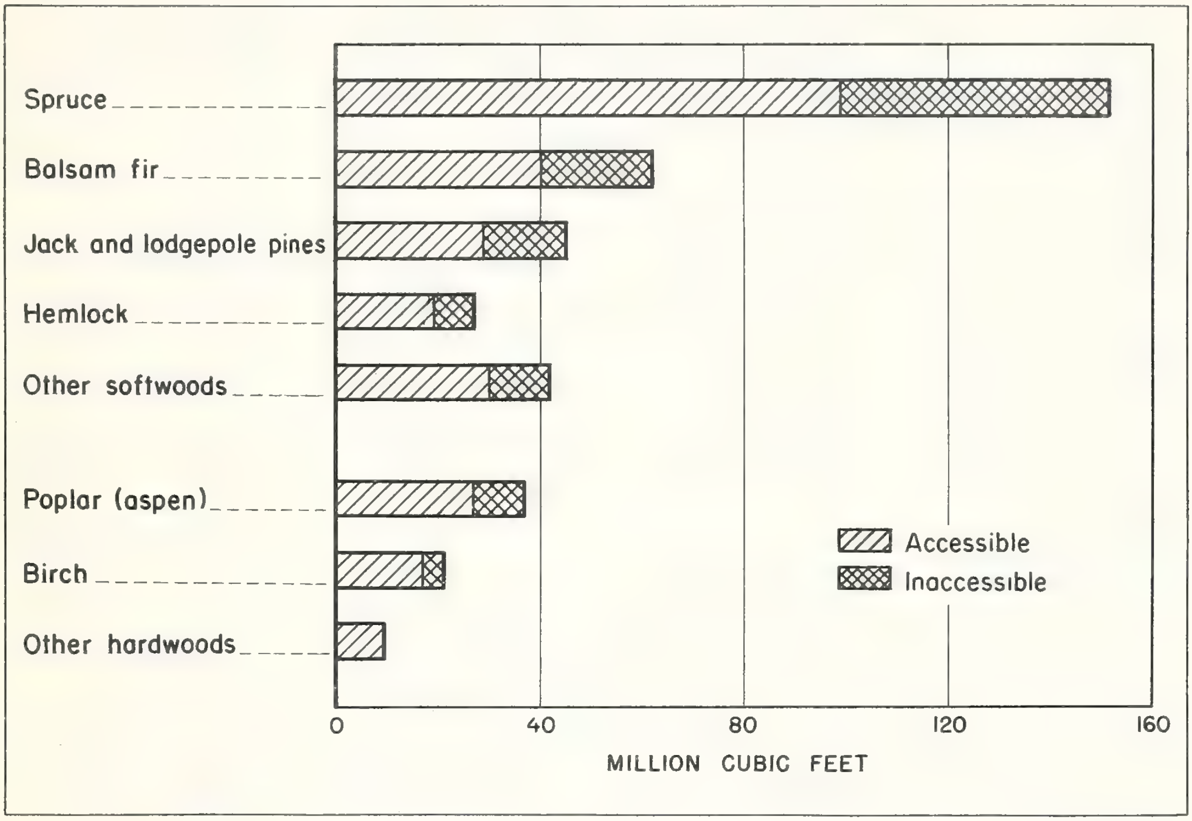

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Fig. 6 – Volume of merchantable timber on commercial forest area of Canada by species, 1953

Table 6.--Volume of sawtimber[1] on accessible forest land, by region, Canada, 1953

Region	Total		Softwood		Hardwood	
	Million bd. ft.	Percent	Million bd. ft.	Percent	Million bd. ft.	Percent
Maritime Provinces[2]	15,822	3	13,041	2	2,781	5
Quebec	52,200	9	38,181	7	14,019	27
Ontario	76,487	13	62,378	12	14,109	27
Prairie Provinces[3]	28,327	5	13,536	3	14,791	29
British Columbia	407,029	70	401,652	76	5,377	11
Yukon and Northwestern Territories	2,807	..	2,077	..	730	1
Total	582,672	100	530,865	100	51,807	100

1/ All trees 10 inches d.b.h. and over.
2/ Newfoundland, Prince Edward Island, Nova Scotia, and New Brunswick.
3/ Manitoba, Saskatchewan, and Alberta.

Source: Canada Dept. North. Affairs and Natl. Resources (formerly Dept. Resources and Devlpmt.), Forestry Branch. Bul. 106. Amend. 1954.

FOREST INDUSTRIES CONTRIBUTE SUBSTANTIALLY TO CANADIAN ECONOMY

In 1951 the forest industries of Canada contributed 2 billion dollars (15 percent) to the net value of the products of all Canadian industries. The contribution of the various segments of the forest-product industries to this total is as follows:

	Percent
Logging	31
Pulp and paper manufacturers	34
Lumber manufacturers	14
Wood-using industries	13
Paper-using industries	8
Total	100

The Provinces of Quebec, Ontario, and British Columbia lead all others in forest industrial effort, accounting for 32; 28; and 25 percent respectively of the 2 billion dollars of the net value of forest industries output.

The Canadian forest industrial plant consists of nearly 8,000 sawmills, 128 pulp and/or paper mills, 50 veneer and plywood mills, nearly 4,000 other wood-using industrial plants, and 421 paper-using establishments. More than 370,000 persons were employed (1951) on a man-year basis. More than a billion dollars were paid in salaries and wages. Between 1940 and 1951 the net value of products produced in these forest industry plants more than quadrupled. Part of this increase, of course, is due to the shrinking value of the dollar. Still further growth in the forest industries will undoubtedly be needed to keep pace with Canada's growing population and expanding industry and agriculture.

TIMBER UTILIZATION COULD BE INCREASED

In 1952 Canadian forest industries consumed 3.6 billion cubic feet of wood. It has been estimated that an additional 700 million cubic feet[4/] were destroyed by fire, insects and disease, making a total drain on Canada's forest resource of 4.3 billion cubic feet. The trend in the total drain is generally upward, the average for the 5-year period 1941-45 being 2.6 billion cubic feet utilization drain and 3.3 billion cubic feet total drain.

4/ In comparison with United States figures, this loss would appear to be very low. From data available it is not entirely clear whether this loss is confined to the accessible commercial forest area or to the total commercial forest area. If the former, the loss is 0.27 percent of the growing-stock volume on the accessible forest area. If the latter, the loss is 0.19 percent of the volume on the total commercial forest area. The corresponding loss for the United States is 0.7 percent of the growing stock volume.

Current timber growth data, even if available, would not be too significant because of the large area of virgin timber having little, if any, net growth. Of greater value in long-time national planning would be an estimate of the growth that can be attained under management after the virgin timber has been replaced by growing stands. Such an estimate has been roughly made by Canadian foresters who state that "It seems probable that, given more intensive forest management including reduction of the high annual losses from forest fires and other natural causes, and with the opening up of.......productive forests now classed as inaccessible, Canada will eventually be able to sustain in perpetuity an output of forest products of more than double the present volume."5/ This would mean an eventual total of at least 7.2 billion cubic feet.6/ Using the most recent estimate of commercial forest area (529 million acres), which can be considered as potentially accessible, an annual growth per acre of 13.5 cubic feet is indicated. This conservative estimate would certainly appear to give adequate recognition to the relatively low growth potential of much of the commercial forest area in the far north. If current timber cut is prorated over the private and occupied public forest area (203 million acres) a commodity cut of 17.7 cubic feet per acre is indicated. Evidently the areas subject to exploitation are already pretty heavily cut. Expansion of output on these areas may be hazardous. However, there is an opportunity for expansion in the large (possibly as much as 231 million acres) area of commercial but unoccupied forest lands.

CANADA'S TIMBER EXPORTS ARE MAINLY TO THE UNITED STATES

Canada ranks third among the nations in volume of world trade; only the United States and the United Kingdom exceed it. With respect to forest products, Canada is the world's leading exporter, having in 1952 an aggregate forest-product export equivalent to 1,625 million cubic feet of roundwood valued at 1.4 billion dollars. In that year exports accounted for 45 percent of all wood utilized commercially. Approximately half of the lumber produced in Canada is currently exported and 75 percent of the paper and veneer; ten to twelve percent of the plywood production is exported.

The United States receives approximately three-fourths of Canadian forest-products exports (table 7). It receives 99 percent of Canadian exports of veneer, 90 percent of paper, 85 percent of plywood, 82 percent of wood pulp, 81 percent of pulpwood and 67 percent of lumber. In general, this is a mutually advantageous relationship. The United

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5/ Food and Agriculture Organization of the United Nations, "Report of the Preparatory Conference on World Pulp Problems, Montreal, Canada, 25 April-4 May, 1949, Canadian Pulp and Paper Association, Montreal, Canada, June, 1949".

6/ No data are available on the board-foot growth, board-foot drain, or board foot allowable cut.

Table 7.--Production and export of principal forest products, Canada, 1952

Product		Production	Total export	Total export as percentage of production	Export to the United States	
					Quantity	Percentage of total export
Lumber	Million board feet	6,780	3,340	49	2,252	67
Pulpwood 1/	Million cubic feet (wood & bark)	1,280	244	19	198	81
Woodpulp	Thousand short tons	8,968	1,941	22	1,589	82
Paper	do.	7,202	5,526	77	4,990	90
Veneer 1/ 2/ ...	Million square feet	551	408	74	400	98
Plywood 3/	do.	595	72	12	61	85

1/ 1951 figures.
2/ 1/10-inch thickness basis. Does not include an unknown footage produced by the furniture and other veneer-using industries.
3/ 1/4-inch thickness basis.

States gets wood products and Canada gets foreign exchange with which to purchase industrial and other products. Canada would, however, prefer to export completely processed wood, such as finished paper and plywood. In the future, Canadian exports of unprocessed roundwood--pulpwood, for example--may decrease in order that greater quantities of pulpwood can be processed in Canada and exported as paper or wood pulp.

Canada's imports of forest products account for only 3 percent of its total imports. Varieties of paper products not manufactured in Canada make up a large part of these imports. Partially manufactured wood products, rosin, turpentine, gums, resins and cork are also imported.

CANADA'S FUTURE WOOD SUPPLIES APPEAR TO BE MORE THAN ADEQUATE FOR DOMESTIC NEEDS

In 1951 the apparent consumption of forest products in Canada was reported as 3.3 billion cubic feet of roundwood. Of this, the equivalent of approximately 1.3 billion cubic feet was ultimately exported in the form of lumber, paper, pulp or other processed form. This left about 2.0 billion cubic feet for the domestic economy of Canada.

During the 20-year period 1933-1953 the rate of increase in the gross national product of Canada closely paralleled the rate of increase in the United States. With good prospects for a still more rapid increase in the Canadian economy due to population growth and to current developments in the production of oil, electric power, and iron and uranium ores, it is possible that during the next two decades the Canadian economy may expand faster than that of the United States. Current study of the future United States requirements[7] for industrial wood on the basis of recent trends, which imply a substantial increase in the real price of industrial wood, indicates an increase of 25 percent between 1952 and 1975. An expansion of 33 percent above current Canadian requirement might not be unrealistic. Concurrently a shrinkage of 25 percent in the consumption of United States fuelwood is indicated. Apparently, Canada's annual fuelwood consumption is not decreasing as rapidly as that of the United States; in fact in 1952 it was 841 million cubic feet, up from the 740 million cubic foot average of 1941-1950. It might not be unreasonable to assume a 700 million cubic foot fuelwood consumption by 1975.

Rough estimates of insect and disease loss in Canada are 500 million cubic feet annually. Fire losses have varied widely owing to fluctuations in severity of fire seasons. A 200 million cubic foot annual fire loss might be reasonable for 1975. These figures indicate an average future loss of 700 million cubic feet from fire, insects and diseases. While this is exactly the annual figure given on page 27 it is felt that the present losses are considerably greater than 700 million cubic feet.

7/ See Chapter VI "Future Domestic Requirements for Timber".

Combining these assumed figures as indicated in the following tabulation, a very rough estimate of 3.0 billion cubic feet is derived for the 1975 wood requirement of the Canadian domestic economy.

	Billion cu. ft.
Current Canadian nonfuel consumption	1.2
Increase in nonfuel consumption (33 percent)	.4
Fire, insect and disease loss	.7
Fuelwood use	.7
Total	3.0

The roundwood equivalent of present exports is 1.6 billion cubic feet, which means that the 1975 Canadian economy plus the present export volume would require 4.6 billion cubic feet of wood. Assuming a growth of 7.2 billion cubic feet after Canada's accessible forest is under management, we have theoretically a margin of 2.6 billion cubic feet for expansion of exports, or for expansion of Canadian consumption above the anticipated 33 percent increase in use of industrial wood. This would be almost entirely of softwood species and primarily of pulpwood size and quality.

The longtime prospects for softwood lumber exports are less bright. On the basis of available statistics, Douglas-fir, perhaps the most important source of high-quality lumber, has a 25-30 year supply on accessible forest land at present rates of cutting. On inaccessible commercial forest land is an additional 10 year supply. The supply of other softwood lumber species appears to be greater.

Considerably more than 20 years will undoubtedly be required to get Canadian forests under such management as will achieve a growth of 7.2 billion cubic feet. On the other hand, Canada has a large area of virgin timber that will put on little, if any, net growth until some or all of the old growth is removed. This static old-growth forest should be converted to a productive condition in an orderly fashion. The rate of this conversion will unquestionably depend upon a number of factors, not the least of which will be administrative policy.

On the basis of the assumptions and calculations heretofore presented, it would appear that by 1975 Canada's forests should be able to support a 33 percent expansion of its economy, to maintain current exports of 1.6 billion cubic feet, and to develop an additional 2.6 billion cubic feet of new exports or domestic demand.

MEXICO'S TIMBER SITUATION

Mexico's timber resources and timber trade are small in comparison with those of the United States and Canada. Nevertheless, the United States does obtain pine lumber and other forest products from Mexico. Consequently, the possibility of continuing these imports warrants separate examination of the forest situation there.

FOREST AREA IS RELATIVELY SMALL

The forest area of Mexico is estimated to be 64 million acres, roughly 13 percent of the total land area. This contrasts strikingly with a corresponding 34 percent in the United States. The following breakdown of this forest area may be roughly indicative of the general forest situation:

Forest category	Area (million acres)	Area (percent)
Commercial forests		
Tropical	27	42
Temperate	22	35
Total	49	77
Noncommercial forests	15	23
All forests	64	100

Roughly 75 percent of the commercial forest area, both tropical and temperate, is considered to be accessible. The tropical commercial forests, all hardwood, consist of some 12 million acres in the Yucatan Peninsula and 15 million acres in the remainder of tropical Mexico (fig. 7). The temperate commercial forests are mixed hardwood and softwood, and include approximately 10 million acres of virgin and moderately exploited areas and 12 million acres of heavy cutovers. The relative abundance of softwood and hardwood species is uncertain, but probably softwoods predominate on one-third of the commercial forest area and hardwoods on two-thirds. The noncommercial forest land is brushland and grazing land with scattered trees.

The pine and pine-oak forests are the most important forest types in Mexico, both from the point of view of area and economic value. They contain some hundred species of oak and 40 species of pine. Among the dozen or more pine species of commercial significance, ponderosa pine (*Pinus ponderosa*), Mexican white pine (*Pinus flexilis var. reflexa*), Limber pine (*Pinus flexilis*) and sugar pine (*Pinus lambertiana*) are the most important.

Pine predominates in the mountains at elevations ranging between 5,000 and 13,000 feet. Ordinarily the pine is gradually replaced by the oak at altitudes below this range. Most of the commercial piñe timber is either in the Sierra Madre Occidental range, which extends from the

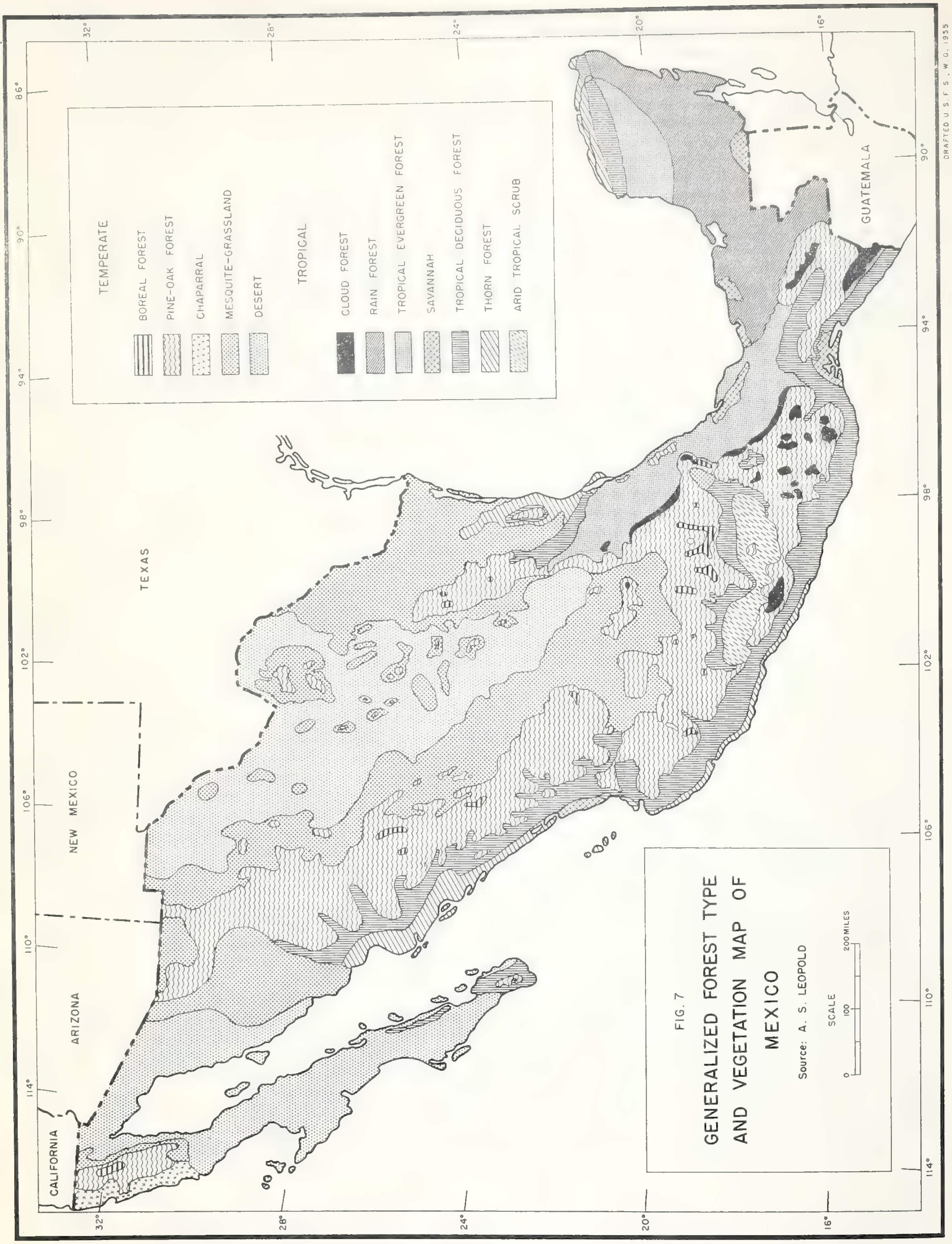

FIG. 7

GENERALIZED FOREST TYPE AND VEGETATION MAP OF MEXICO

Source: A. S. LEOPOLD

Arizona border southward through the western half of the country, or is in the south coastal Sierra Madre del Sur. In east central Mexico the Sierra Madre Oriental contains some pine at the higher elevations, but rough topography and light stocking practically disqualify it as a commercial source of timber. Even in the other mountain areas, much of the timber on high and rough terrain is at present out of economic reach. The development of railroad and road transportation appears to be needed to open up these softwood stands. In some instances, at least, it is questionable if the timber values on present markets are worth the investment and operating risks that would be involved.

The Mexican rain forest, prominent in the Yucatan Peninsula and westward in the Isthmus of Tehuantepec, occurs in the low, humid, tropical areas of heavy rainfall. Although several hundred tree species are found within this type, it is chiefly prized for the scattered occurrence of three particularly valuable species: mahogany (Swietenia macrophylla), chicle (Achras zapota), and ramon (Brasimum alicastrum). In many areas the forest cover is broken or reduced to secondary scrub because of shifting cultivation or heavy exploitation.

For the Nation as a whole the forest land is owned about as follows:

	Percent
Federal	5
Communal	20
Private	75
Total	100

This ownership pattern generally approximates that of the continental United States, where 74 percent of the commercial forest area is privately owned. The communal forests are of special significance because they are concentrated in the heavily populated and agriculturally important central plateau region. In 1949 about 2 million acres of federally owned forests were in national parks and 1.6 million acres were in forest reserves.

TIMBER VOLUME IS SMALL

No reliable estimates of Mexico's total timber volume exist. Recent approximations of average timber volume per acre range from 700 cubic feet for all forests to 2,000 cubic feet for accessible commercial forests. Assuming an average of 1,200 cubic feet per acre of commercial forest, the commercial timber volume would total about 59 billion cubic feet. The total timber volume on commercial forest land in the United States is 498 billion cubic feet. There is no basis for breaking down this 59 billion cubic feet by species, geographic area or quality.

FOREST INDUSTRIES ARE DEVELOPING

Reliable statistics on the Mexican forest industries are also lacking, but these industries occupy only a minor position in the national

economy. In 1953 forestry and the forest products industries accounted for about 2 percent of the gross national product.

In general, forest operations are conducted on a modest scale. Tree-felling is usually done with axe and handsaw; skidding is ordinarily done with horses, mules or oxen. Only on the Yucatan Peninsula are tractors regularly used for skidding. Ordinarily logs are transported from forest to mill by truck.

Sawmills are Locally Important

It is estimated that 170 sawmills operate in Mexico, producing in 1951 some 530 million board feet of lumber. In addition, possibly 100 million board feet or more was handsawn in that year, chiefly for railway crossties. Three Mexican mills use bandsaws; all others use circular saws. The band mills and a few of the larger circular mills are reasonably modern and efficient and can produce lumber meeting export specifications. Most of the other mills are not so well equipped, and are unable to produce well-sawn lumber. The largest band mill has a daily capacity of more than 100,000 board feet, and the circular mills produce an average of about 10,000 board feet daily. A few mills have dry kilns, and most of the lumber is air-dried briefly before it is marketed. Ordinarily lumber is graded only when it is exported. Currently pine lumber export accounts for 58 percent of the value of all forest products exported (including nonwood forest products).

It is reported that five or six United States-owned but Mexican-staffed sawmills are now operating in the States of Chihuahua and Sonora and are exporting the sawn lumber under license through Laredo, Texas and other border towns. Little is known regarding the size and ownership of these mills but their concession areas are known to be on private land. It is doubtful if, under present regulations governing the operation of foreign-owned enterprises in Mexico, new United States timber concessions will be opened. The Mexican Government appears to favor the establishment of domestically controlled processing plants and the export of such finished forest products as furniture, for example.

Pulp and Paper Mills Partially meet National Needs

Of the 25 mills involved in the production of pulp and paper, 15 produce paper only, six produce paper and mechanical pulp, three produce paper and chemical pulp and one produces paper and both types of pulp. Annual capacity of the industry is reported to total about 240,000 short tons of paper. In 1953, production was estimated to be 132,000 tons of paper. The consumption is roughly estimated at 265,000 tons (1953). The import of 73,000 tons of newsprint in 1953 approximately accounts for the total consumption of that item. Of this 74 percent came from Canada, 12 percent from the United States, 12 percent from Finland and 2 percent from other European countries. Some pulp was also imported, especially bleached and dissolving pulps. The chief reason why pulp and paper production is so far below capacity is that the industry is concentrated in and near Mexico City where raw material supplies are now very scarce. It is anticipated that by 1965 the demand for paper and board may be 600,000 tons.

Plywood Production is Increasing

Seven major plywood plants now operate in Mexico and in 1950 produced some 65 million square feet of plywood, ¼-inch basis. Three of these plants are in the pine region, three in the tropical region, and one is in Mexico City. A number of smaller mills produce small quantities of plywood, and also veneer for baskets, boxes and crates. Construction plywood accounts for the bulk of the Mexican production, but the production of decorative plywood for furniture and paneling is increasing. Pine and oak are commonly used for construction plywood, and mahogany, Spanish cedar and prima vera for decorative plywood. Plywood exports, chiefly of Spanish cedar, were more than 8 million square feet in 1950. The United States is the principal buyer.

Wood is Widely used for Fuel

Wood fuel, largely in the form of charcoal rather than wood, is the basic household fuel in Mexico. The volume of wood cut annually to meet this need is not known but may be conservatively estimated at about 260 million cubic feet. This is believed to be about 40 percent of the total utilized cut of timber. Charcoal is made by primitive and wasteful methods in crude, earth-covered mounds. Much of the timber converted to charcoal would be far more valuable if otherwise utilized.

Nonwood Forest Products are also Important

In the production of naval stores, Mexico ranks sixth among the producing countries in the world, and during the period 1947-1951 produced about three percent of the world's production of turpentine and rosin. Except for one modern plant at Guadalajara, naval stores are produced in small, scattered plants. Tapping methods are generally severe, and much pine timber is lost because of heavy working for naval stores coupled with fire and insect damage. No wood naval stores are produced. During the period 1947-1951 Mexico produced on the average 1.5 million gallons of turpentine and 24,314 short tons of rosin. About two-thirds of the turpentine and one-half of the rosin produced is exported. The rosin is chiefly exported to European and other Latin-American countries, and the turpentine to the United States.

Chicle, the natural base for chewing gum, is produced from the exudation of the sapodilla tree which occurs in the tropical forests of southeastern Mexico and adjacent areas in Central America. The number of productive trees is rapidly shrinking because of excessive and indiscriminate tapping. The increasing availability of synthetic substitutes for natural chicle suggests that this industry will steadily decline in economic importance.

A few miscellaneous forest product industries are known to be more or less active, but data on their output are lacking. These include a modern wallboard plant, a few small barrel and cask factories, furniture plants, and tannin extraction plants.

TIMBER DRAIN IS THOUGHT TO EXCEED GROWTH

It is estimated that the average gross growth of Mexican forests is in the neighborhood of 14 cubic feet per acre per year. The total gross

timber growth on commercial forest land may therefore approximate 700 million cubic feet. Noncommercial forest land supports almost no merchantable timber and makes no significant contribution to the usable timber growth.

Volume losses from fire, insects, disease, shifting agriculture, and other causes are unknown but are thought to be large. Partial reports indicate that during the period 1944-1953 fire destroyed about 105,000 acres annually. During 1948-1952, bark beetle epidemics were reported to have covered about 35,000 acres annually. Assuming an average stocking of 1,200 cubic feet per acre and a 25 percent salvage rate, these partial estimates account for a loss of 125 million cubic feet. A more complete accounting of such losses might reach 200 million cubic feet. This would give a net annual growth of 500 million cubic feet or less than one percent of the timber volume on commercial forest land.

A 1952 estimate of 700 million cubic feet for the annual timber cut is considered to be realistic. Accepting above assumptions an annual timber deficit of some 200 million cubic feet would be indicated. However, estimates of commercial forest area, timber volume, and growth rates vary so widely as to shake confidence in the above calculation, even though it appears to rest on a reasonable base. Of course, a considerable forest area supports virgin timber, on which growth about offsets mortality. When this virgin timber is replaced by a young growing forest the total growth will be increased. Whether this increase will place Mexican timber production on a sound footing cannot be forecast at this time.

FOREIGN TRADE IN FOREST PRODUCTS IS CHIEFLY WITH UNITED STATES

Trade with the United States accounts for 80-90 percent of Mexico's total foreign trade. The United States is the source of 95 percent or more of Mexico's imports of forest products, and is also the destination of most of Mexico's exports of such products. In terms of the total value of 1953 trade with the United States, forest products probably accounted for some 4.5 percent of Mexican exports and 3 percent of imports.

In 1952 Mexico's excess of wood exports (excluding pulp and paper products) over wood imports in trade with the United States was equivalent to 9.5 million cubic feet of roundwood. Lumber accounted for about 97 percent of the volume of wood products exported to the United States and 83 percent of the wood volume imported from the United States. In terms of roundwood equivalents, Mexico's 1952 wood exports were about 2.1 percent of estimated wood production. Postwar export restrictions and government production controls and other factors have caused a steady decline in the equivalent total volume of wood shipped from Mexico to the United States as is shown in the following tabulation:

Year	Million cu. ft.
1950	30
1951	20
1952	15
1953	12
1954	11

When the value of wood pulp and its derivatives and nonwood forest products are considered along with the value of wood products, Mexico is a net importer of forest products from the United States. The value of all of these forest-product imports in 1953 was $20.5 million and of the corresponding exports $15.5 million.

FOREST-PRODUCT EXPORTS LIKELY TO DECLINE

Evidence--apparently trustworthy--indicates that Mexico's forest resources are shrinking. Regardless of this, there are strong indications that, for the immediate future, at least, Mexican exports of wood and wood products will gradually shrink as the nation seeks self-sufficiency in these items. It would therefore appear that the United States cannot count on increases in imports of these items from Mexico.

THE WORLD TIMBER SITUATION

To complete the setting in which the timber situation of the United States should be appraised, a very brief look at the world's forest resources and timber trade is in order. However the political situation which divides the world today has largely cut off timber trade between the free world and the Soviet Bloc of nations. Consequently the following discussion deals primarily with the forest resources of the free world, although some reference to total world timber resources, and comparisons between free world and Soviet Bloc resources are also given.

The discussion is largely based on the results of the 1953 world forest inventory conducted by the Food and Agriculture Organization of the United Nations.8/ The statistics were obtained from a questionnaire sent to member nations by F.A.O. of which 126--accounting for 73 percent of the world's forest area--replied. The essential information for the other countries was obtained from published official statistics, from questionnaires submitted in connection with a similar F.A.O. survey in 1947, from unofficial reports, and from estimates of F.A.O. personnel.

ONLY ONE-FOURTH OF FREE WORLD'S FORESTS UNDER EXPLOITATION

The total forest area of the free world is estimated to be 7.4 billion acres (table 8). Softwoods predominate on 1.5 billion acres, hardwoods on 5.9 billion. Seventy-six percent of the free world's softwood forest is in North America. Much of the rest is in free Europe. About eighty-four percent of the hardwood forests are in Latin America, Africa, and free Asia. Of the total forest area, some 4.0 billion acres are considered to be inaccessible. These latter forests are naturally found in remote areas, such as the colder zones of Alaska and Canada and the difficult parts of Latin America, Africa, and Asia. The improvement in communications that normally accompanies general economic development together with improvements in logging and transportation equipment is steadily reducing the inaccessible forest area.

Of the 3.4 billion acres of accessible forest, 1.9 billion acres are in use, i.e., under exploitation. Thus approximately one-fourth of the total forest area is actually under exploitation. Virtually all of free Europe's forest areas are in use, but in Latin America less than one-tenth of the forest area is being exploited. By and large the areas in use are the choicest and most economic ones with respect to traditional means of transportation and to present centers of population. The 1.4 billion acres of accessible forest not yet under exploitation will undoubtedly be put under use when economic conditions justify. Yields on some of these areas may be low and the species composition and timber quality may be relatively poor. Considering the free world total, it would appear that the untapped forest resources are large.

8/ Published under the title "World Forest Resources", Rome, 1955.

Table 8.--Approximate distribution of the free world's forests, 1953 1/

Region	Total land area	Forested area			Accessible forests 2/	Forests under exploitation 3/		
		Total	Softwoods	Hardwoods		Total	Softwoods	Hardwoods
	Million acres	Million acres	Million acres	Million acres	Million acres	Million acres	Million acres	Million acres
North America 4/	4,974	1,799	1,165	634	916	709	402	307
Latin America 5/	5,046	2,135	58	2,077	775	194	24	170
Free Europe 6/	249	270	161	109	263	258	157	101
Free Asia 7/	2,393	1,054	114	940	661	485	32	453
Pacific Area 8/	2,113	212	19	193	49	42	5	37
Africa	7,339	1,980	8	1,972	702	267	5	262
Total, Free World	22,114	7,450	1,525	5,925	3,366	1,955	625	1,330

1/ Source: World Forest Resources. Food and Agriculture Organization of the United Nations, Rome, Italy. pp. 1-120, illus. 1955. Data for North America revised to agree with statistics for individual countries given in other parts of this report.

2/ All forests now within reach of economic management or exploitation as sources of timber products, including immature forests and managed forests where fellings were prohibited.

3/ Forest yielding industrial wood and/or fuelwood.

4/ Includes United States, Alaska, Canada (excluding Labrador) and Mexico.

5/ Includes Central and South American countries listed in Table 1, page 60 of above report.

6/ Includes European countries listed in Table 1, page 60 of above report except for the following: European USSR, Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland and Rumania.

7/ Includes Asiatic countries listed in Table 1, page 66 of above report except for the following: Asiatic USSR, China, Manchuria, Tibet, North Korea, and Viet Minh.

8/ Includes Australia, British Solomon Islands, Fiji, Hawaii, New Guinea (Australia), New Zealand, Western Samoa and others as shown in Table 1, page 68 of above report.

SOFTWOOD FORESTS MORE HEAVILY EXPLOITED THAN HARDWOOD FORESTS

Of the 1.9 billion acres under exploitation, approximately 625 million acres are of softwood types and 1,330 million are hardwood. Thus 41 percent of the softwood forests are under exploitation whereas only 22 percent of the hardwoods have yet been opened up for commercial operation.

Data are not available to warrant an estimate of the total timber volume of the free world. It is, however, estimated that the 1.9 billion acres of forest now under exploitation support 2,431 billion cubic feet of growing stock (with bark), of which 35 percent is softwoods. An approximate breakdown of this volume is shown in table 9. More than two-thirds of the softwood volume is found in North America while free Asia has 43 percent of the hardwood volume in forests under exploitation (table 9).

The volume of timber cut from the free world's forests in 1953 is estimated at 36.8 billion cubic feet--17.0 billion cubic feet softwood and 19.8 billion cubic feet hardwood. This volume does not include unrecorded removals and illicit fellings in some countries which may account for substantial volumes in those parts of the world where accurate records are not maintained. North American countries account for about two-fifths of the total cut of all species in free world's forests--nearly two-thirds of the total softwood volume and about one-fifth of the total hardwood volume (see regional fellings page 44).

Of the volume removed from the forests of the free world, approximately 47 percent was used for fuel and 53 percent was used for industrial wood. The proportion of output that is industrial wood has been increasing during recent years.

On the basis of data from countries having about four-fifths of the world's exploited forest, net annual growth for the free world's forest area under exploitation is estimated roughly at 18 billion cubic feet of softwood and 35 billion cubic feet of hardwood (without bark). All in all, it appears that in the exploited forests of the free world as a whole, net growth of softwoods is slightly in excess of depletion of growing stock by cutting. However, for much of Europe, for the United States, and for other parts of the free world, the requirements for softwoods are in excess of annual growth and throughout the world the softwood requirement is increasing.

In the case of the exploited hardwood forests, best judgment indicates that removals from the forest may be only one-half to three-fourths of the growth. In the United States, and in other parts of the world as well, certain hardwoods can be and are being substituted for softwoods. As research discovers ways of using hardwood species for products traditionally made of softwoods, acceleration in hardwood use may reduce somewhat the pressure on the softwood resource.

Table 9.--Growing stock in the free world's forests under exploitation, 1953 1/

Region 2/	Growing stock (with bark) 3/						Estimated growing stock per acre	
	All species		Softwood		Hardwood		Softwood	Hardwood
	Billion cu. ft.	Percent	Billion cu. ft.	Percent	Billion cu. ft.	Percent	Cubic feet	Cubic feet
North America	836	34	601	70	235	15	1,495	765
Latin America	284	12	35	4	249	16	1,458	1,465
Free Europe	275	11	179	21	96	6	1,140	950
Free Asia	718	30	31	4	687	43	970	1,520
Pacific Area	35	1	7	1	28	2	1,072	786
Africa	283	12	4	(4/)	279	18	575	1,072
Free world	2,431	100	857	100	1,574	100	1,366	1,187

1/ Source: World Forest Resources. Food and Agriculture Organization of the United Nations, Rome, Italy. pp. 1-120, illus. 1955, except for the United States for which growing stock includes volume on commercial forest land increased 10 percent for bark.

2/ For included countries see references cited in footnotes to table 8.

3/ Growing stock volumes may not check with products of given acreages and volume per acre because of rounding.

4/ Less than 0.5 percent.

CANADA, UNITED STATES, AND FREE EUROPE DOMINATE WORLD TIMBER TRADE

The equivalent of about one-ninth of the total free world fellings of roundwood entered international trade in 1953 either in round or processed form. The extent of the foreign trade for major world regions is indicated by the following tabulation:

Region	Regional fellings (billion cu. ft.)			Foreign trade (billion cu. ft.)	
	Total	Softwoods	Hardwoods	Imports	Exports
North America	15.1	11.0	4.0	1.53	1.73
Latin America	5.6	.4	5.2	.15	.08
Free Europe	6.7	4.0	2.7	1.92	1.97
Free Asia	4.7	1.3	3.4	.26	.18
Pacific Area	.8	.2	.6	.06	.01
Africa	4.0	.1	3.9	.13	.08
Total	36.8	17.0	19.8	4.05	4.05

The volumes entering international trade include trade between countries within each world region as well as trade between world regions. Viewing the situation by world regions, only free Europe and North America show a net export. The other regions of the free world are net importers.

Pinpointing the situation, three countries--Canada, Finland and Sweden--account for 69 percent of the free world's wood-product exports (on roundwood equivalent basis); two countries--the United States and the United Kingdom--account for 57 percent of the free world's wood-product imports.

Canada, Finland, and Sweden export chiefly paper, woodpulp, pulpwood and softwood lumber. The United States imports chiefly newsprint paper, woodpulp, and softwood lumber, while for the United Kingdom the order of importance in imports is softwood lumber, woodpulp, pit props and paper. From the character of the import and export items of those nations that dominate world trade in timber products, it is apparent that the backbone of such trade is in softwood products.

The pattern of world trade in various forest products varies greatly depending upon the bulk and relative value of the individual products. For example, there apparently is almost no limit on the distance that newsprint and other paper and some pulp items can be shipped. At the other extreme, fuelwood is seldom exported, or transported very far even within a country. International trade in forest products is therefore practically limited to industrial wood or the products processed from industrial wood.

The flow of international trade in the four principal categories of timber products entering such trade in 1949 is shown on a regional basis in figures 8 to 11. These charts show that the bulk of the trade in

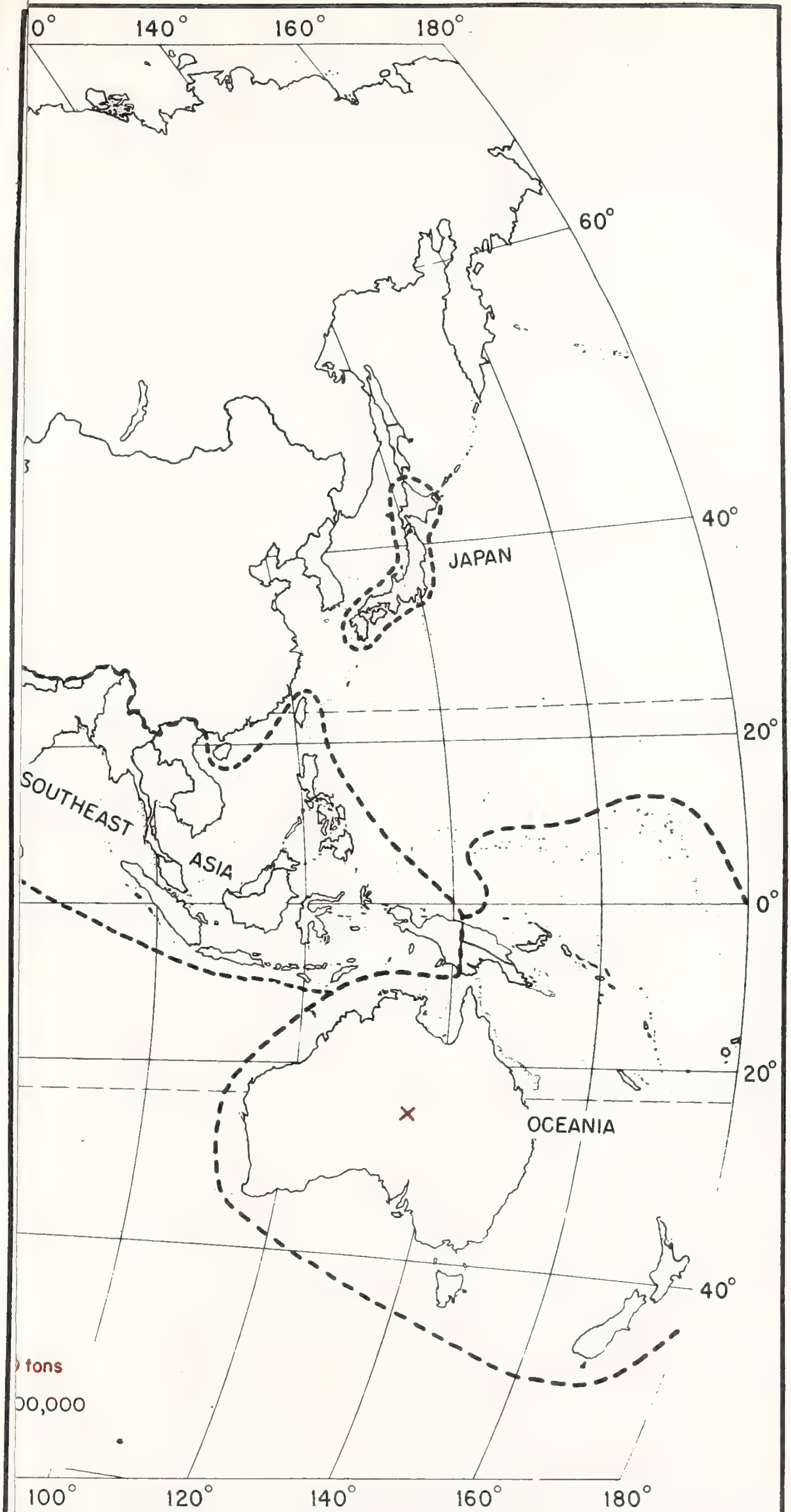

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FIG. 8- FREE WORLD TRADE IN WOOD PULP, 1949

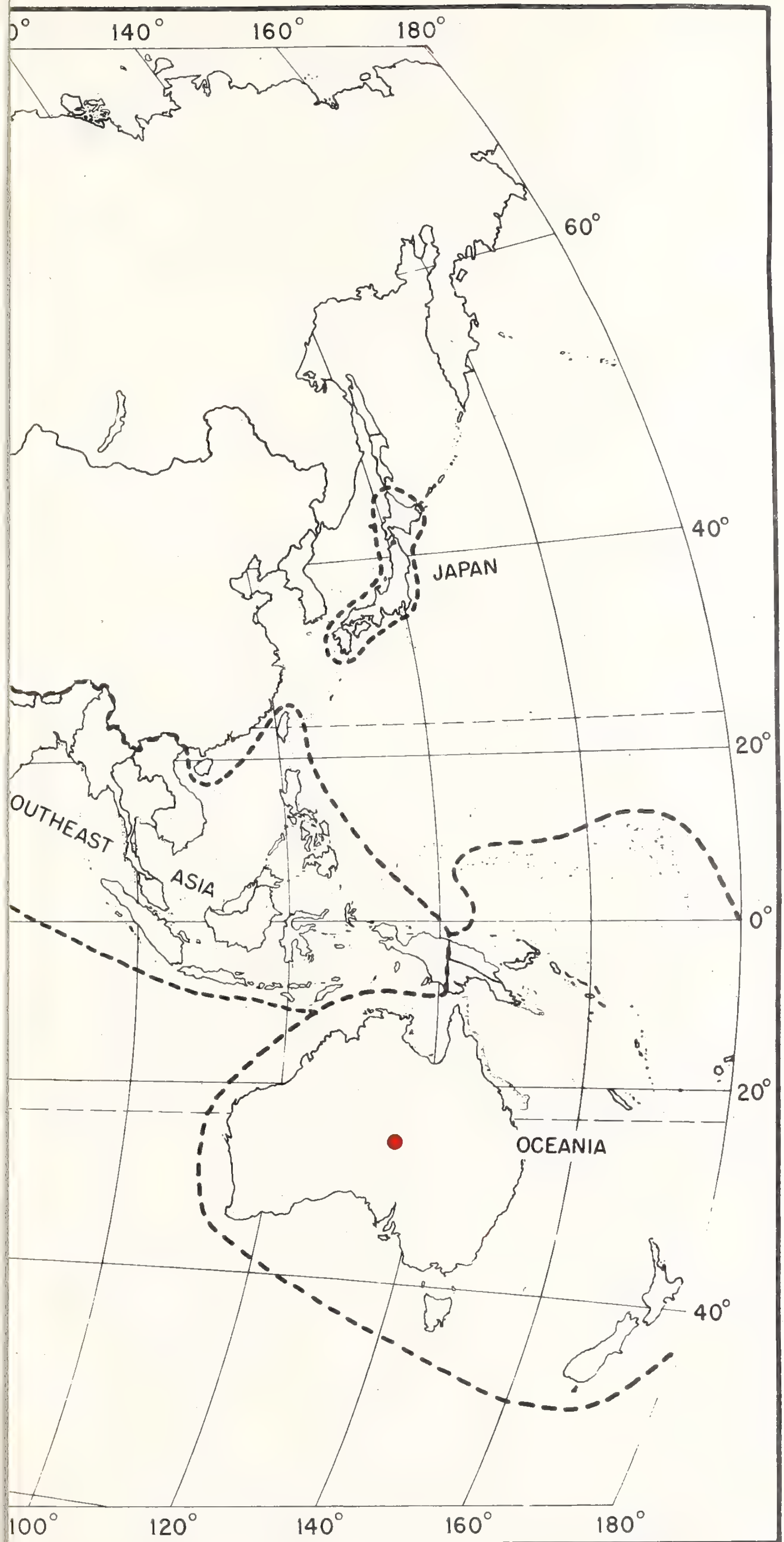

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FIG. 9 - FREE WORLD TRADE IN NEWSPRINT PAPER, 1949

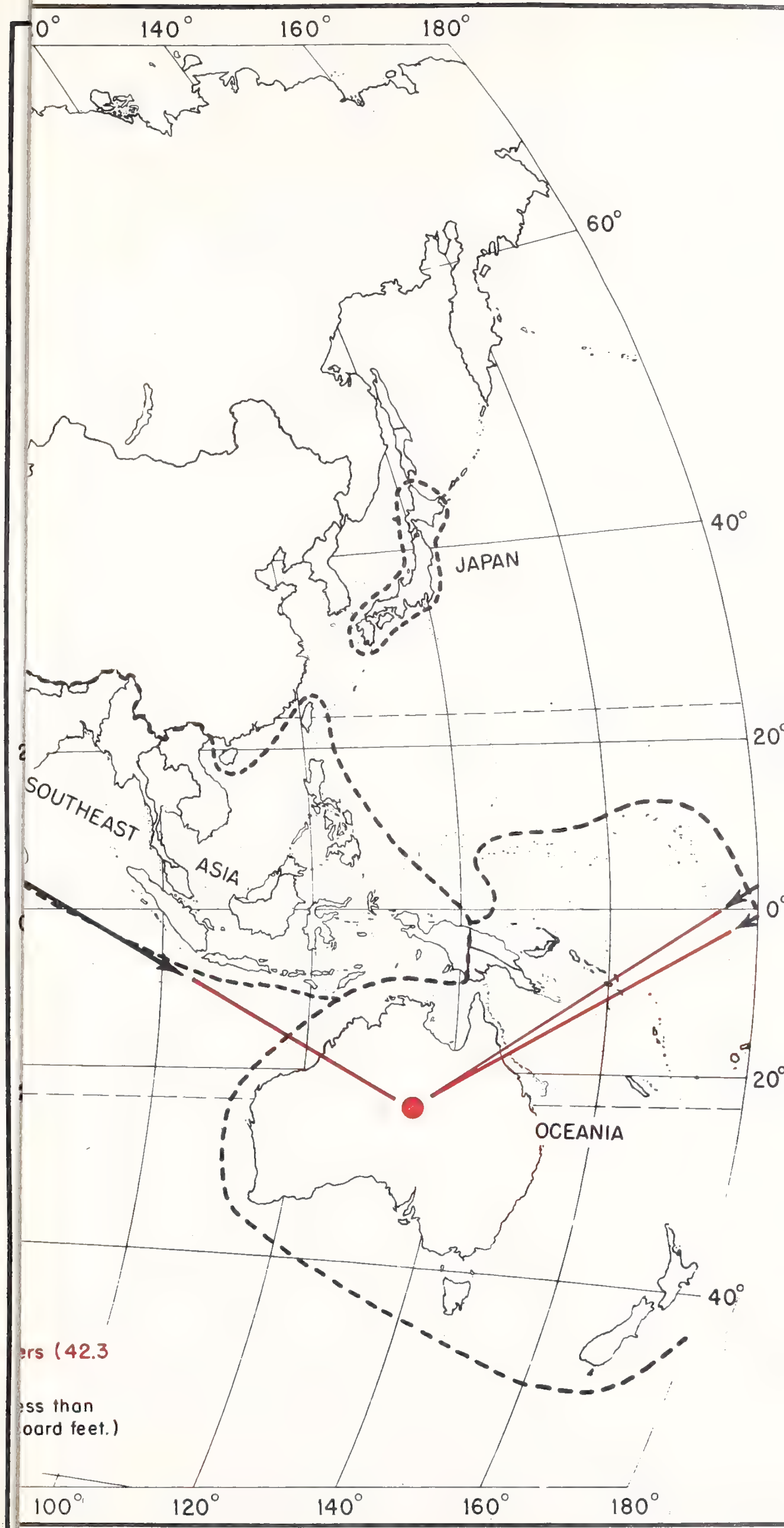

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FIG. 10 - FREE WORLD TRADE IN SOFTWOOD LUMBER, 1949

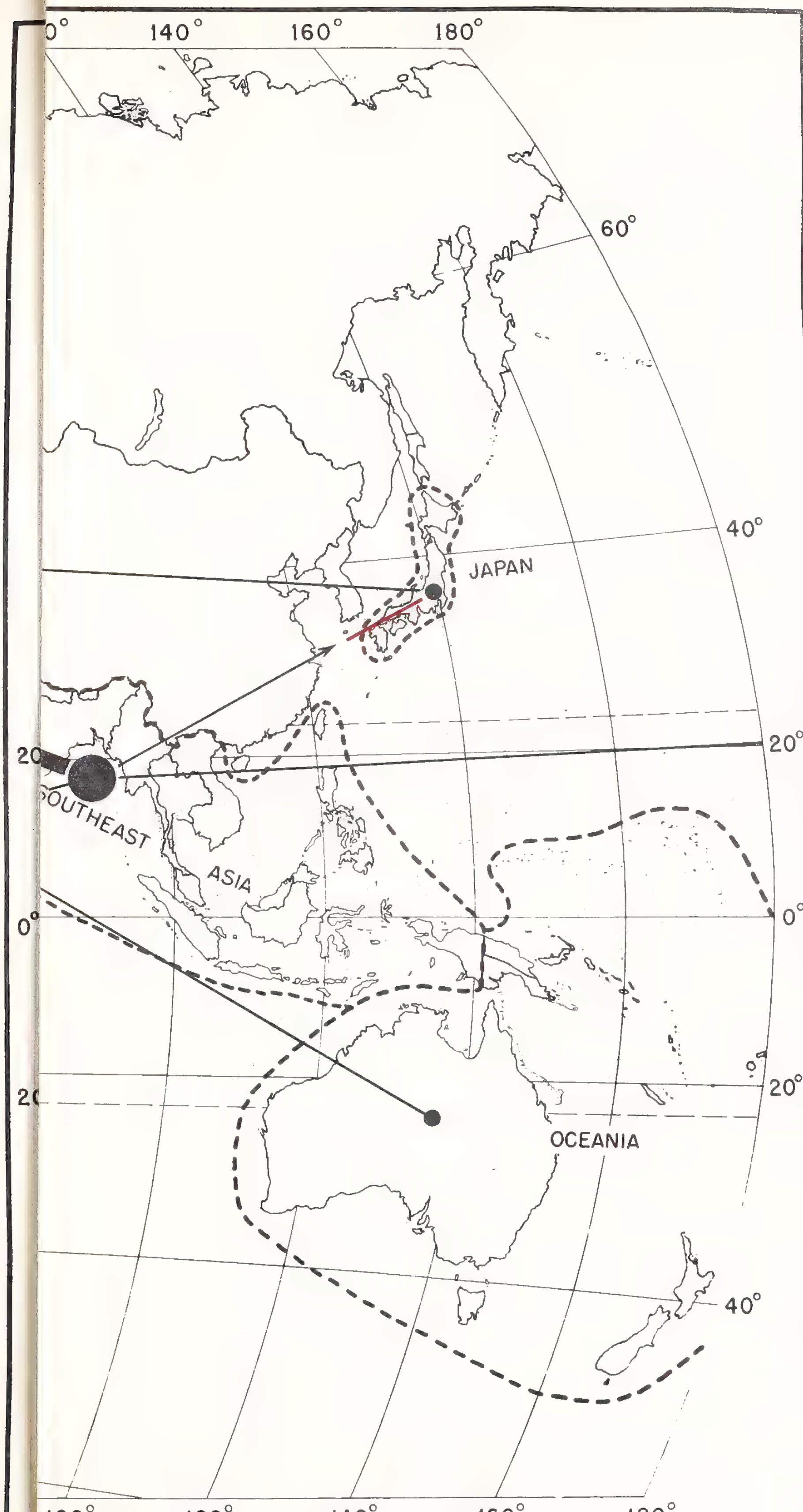
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FIG. II- FREE WORLD TRADE IN HARDWOOD LUMBER, 1949

newsprint paper is from Canada to the United States. Most of the woodpulp trade is from Canada and Europe to the United States. The flow of softwood lumber is more diversified, although a large volume moves from Canada to the United States and to Europe. The flow of hardwood lumber is still more diversified, with free Europe, Free Asia, Africa and South America participating importantly.

FREE EUROPE LIKELY TO NEED ITS OWN OUTPUT

Because free Europe accounts for 45-50 percent of the volume of world trade in forest products, because much of the European international trade is in softwoods, and because in the past Europe has exported a considerable volume of forest products to the United States, it will be helpful to consider more closely the free European softwood timber-supply situation.

Since 1935, free European sawn softwood consumption has shrunk by a fifth. Several factors have contributed to this. During the Nazi regime the cut of the German-controlled forests exceeded the allowable cut of their management plans in order to support the German military operations. This overcut continued during the first years of occupation. Accordingly, the restoration of German forests to former productivity requires a reduction in annual cut for an extended period. A parallel situation prevails in certain other countries. It is expected that within one to three decades European forests will again be able to support heavier cutting. A sharp curtailing of the output of timber products in some exporting countries has reduced the volume of exports available to other countries, even though the proportion of the output going into export may have been approximately maintained.

World War II seriously disrupted European imports of softwood forest products. The considerable volume normally imported into free Europe from the countries now under Communist influence have been greatly reduced, although strenuous efforts are being made in some quarters to renew this trade. In the case of United Kingdom, dollar shortages have discouraged imports from Canada. The net results of this reduced supply of softwood timber in free Europe has been a sharp increase in the price of softwood forest products and a reduction in consumption.

Looking ahead to 1960 it is estimated that, even assuming a conservative rate of economic growth and 1950 prices, the requirement for all industrial wood in Europe (excluding USSR but including satellite countries) is expected to reach 6.9 billion cubic feet. The corresponding figure for 1950 was 5.9 billion cubic feet. Under present policies and programs, European production of industrial wood by that time will not exceed 5.5 billion cubic feet. From this it would appear that, for several decades at least, almost the entire softwood surplus of exporting countries, such as Sweden, Finland, and Norway, could be utilized within Europe.

UNITED STATES CAN CONTINUE TO IMPORT BUT EXPANSION OF EXPORTS LIMITED BY DOMESTIC NEEDS

The United States has long been a net importer in respect to pulpwood, woodpulp, and paper. Up to about 1940, however, it has maintained a net export balance in both hardwood and softwood lumber (table 10). Now, with lumber exports sharply reduced, and with imports higher than in any earlier period, this country is also a net importer of lumber. Imports of softwood lumber and newsprint paper have increased particularly sharply since World War II. Since 1950 imports of softwood lumber have averaged about 2.6 billion board feet or 8 percent of domestic softwood consumption. In the same period imports of newsprint paper reached about 5 million tons a year--83 percent of consumption. Our imports of both of these items come chiefly from Canada, as does our 2-million ton import of woodpulp, and our 1.5-2.0 million cord import of pulpwood. Hardwood lumber--of which imports between 1950 and 1954 averaged 236 million board feet and exports 130 million--comprises a much smaller volume of trade than softwood lumber and pulp and paper products.

Looking to the future, interest centers on softwood trade. Although important segments of the free world face a shortage in softwood timber, the United States is in a favorable position with respect to supplies from undeveloped regions. Proximity and established trade relations might enable the United States to obtain substantial additional amounts annually from Canada and there are untapped resources in Interior Alaska. Supplementary supplies from these sources may help in meeting expanding needs of the American economy in the years ahead.

Whether the United States will be able to increase its exports of timber products to help meet the widespread need in other parts of the world will depend on the relative needs of its own expanding economy. Domestic requirements as estimated for 1975 and 2000 will tax our own supplies to the utmost, even allowing for continued imports, at present levels, of pulp and paper and other special items. True, we hold a dominant position in the free world's timber economy in terms of forest area, timber volume, productive capacity, and output of timber products. But our needs are great and will grow in response to our expanding population and other factors. Thus, while we may be able to effect some slight increases in timber products for needy nations it is unlikely that we will be able to expand our exports to any substantial degree, particularly if our own needs are as great as expected.

RELATION OF NORTH AMERICAN FOREST RESOURCES TO THOSE OF THE FREE WORLD AND WORLD

A comparison of forest resources of North American countries is presented in table 11. It seemed desirable in these comparisons to rely on pertinent statistics for the different countries, appearing in other sections of this report which are more or less similar to the standards adopted by the United States in reporting on its forest resources. However, comparison of resources between all countries and regions of the world must be on the basis of statistics which are reasonably comparable for the various countries considered. Thus World Forest Resource statistics

Table 10.--United States: Imports and exports of principal forest products

IMPORTS

Year	Softwood lumber	Hardwood lumber	All woodpulp	Newsprint paper	Pulpwood
	Billion bd. ft.	Billion bd. ft.	Million tons1/	Million tons1/	Million cords
1925	1.73	0.11	1.66	1.45	1.09
1930	1.15	.04	1.83	2.28	1.10
1935	0.38	.06	1.93	2.28	1.04
1940	.61	.12	1.22	2.76	1.44
1945	.88	.16	1.75	2.67	1.73
1950	3.14	.28	2.39	4.86	1.83
1951	2.26	.25	2.36	4.96	2.51
1952	2.27	.21	1.94	5.03	2.31
1953	2.53	.23	2.16	5.00	1.55
1954	2.85	.21	2.05	4.99	1.60

EXPORTS

1925	2.19	0.37	0.04	0.02	0.01
1930	1.91	.42	.05	.01	.13
1935	1.00	.31	.17	.02	.02
1940	0.75	.17	.48	.04	.06
1945	.29	.12	.14	.04	.04
1950	.41	.11	.10	.04	.03
1951	.88	.12	.20	.07	.01
1952	.57	.16	.21	.11	.02
1953	.51	.13	.16	.05	.01
1954	.58	.13	.44	.14	.04

1/ 2,000 pounds.

as published by the Food and Agriculture Organization of the United Nations are used for this purpose. Because F.A.O. used different standards and definitions, the North American data used in world comparisons is somewhat different than North American data in table 11 and elsewhere in the Timber Resource Review.

A partial summary of these world statistics by country and region is given in table 12. Although these same statistics for North America and the free world appear in tables 8 and 9 they are duplicated here in order that significant relationships between these and other parts of the world may be readily apparent.

United States Resources in Relation to Those of North America

About 1.8 billion acres or 36 percent of the land area of North America is forested, and slightly more than 60 percent (1.1 billion acres) of the forested area is considered commercial (table 11). The United States and Alaska have 48 percent of the commercial forest area, Canada 48 percent and Mexico 4 percent. Whereas the United States has a smaller acreage of softwoods than Canada it has a greater proportion of the softwood volume--52 percent as compared to 45 percent for Canada. Annual timber growth and cut are also much higher in the United States where both growth and cut equal approximately 70 percent of the total for all of North America. Canada accounts for all but a small fraction of the remainder in both categories.

North American Resources in Relation to Those of the Free World

Both Latin America and Africa have more forest area than North America. But it is the relative distribution of the softwood resources among nations of the free world that is most significant. Whereas North America has only 24 percent of the forested area it has 76 percent of free world's softwood forests, about 64 percent of softwood forests under exploitation and about 70 percent of the softwood timber volume of forests being exploited. These and other relationships are shown below and in table 12.

Distribution of Free World Forest Resources

	North America	Latin America	Free Europe	Free Asia	Pacific Area	Africa	Total
	Percent						
Total forested area	24	29	4	14	3	26	100
Softwood types	76	4	11	7	1	1	100
Hardwood types	11	35	2	16	3	33	100
Forests under exploitation	36	10	13	25	2	14	100
Softwood types	64	4	25	5	1	1	100
Hardwood types	23	13	7	34	3	20	100
Timber volume 1/	34	12	11	30	1	12	100
Softwood	70	4	21	4	1	..	100
Hardwood	15	16	6	43	2	18	100

1/ On forests under exploitation.

Table 11.--Forest resources of North America, 1953

Country	Total land area	Total forest land	Forest land: Commercial: Total	Commercial: Softwood	Commercial: Hardwood	Non-commercial
	Million acres	Million acres	Million acres	Million acres	Million acres	Million acres
United States	1,903	648	484	230	254	164
Alaska 1/	366	136	44	33	11	92
Canada 2/	2,218	951	529	396	133	422
Mexico	487	64	49	16	33	15
North America	4,974	1,799	1,106	675	431	693

Country	Timber volume 3/: All species	Timber volume: Softwood	Timber volume: Hardwood	Net annual timber growth 4/	Timber cut 4/
	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.
United States	498	337	161	14.2	10.7
Alaska 1/	50	41	9	1.0	(5/)
Canada 2/	397	328	69	6/ 4.5	3.6
Mexico	59	19	40	0.5	0.7
North America	1,004	725	279	20.2	15.1

1/ Combines Coastal and Interior Alaska.
2/ Excludes Labrador.
3/ On commercial forest land.
4/ Of growing stock on commercial forest land.
5/ Less than 0.05 billion.
6/ Questionable estimate. Growth on areas not under exploitation is probably less than on areas now being exploited. If the stands were comparable, total growth on commercial forest land would be about 6.6 billion cubic feet. The estimate shown is about halfway between these two extremes.

Table 12.--Forest resources of the world, 1953 1/

Country or region	Total land area	Forested area: Total all types	Forested area: Softwood portion	Accessible forests 2/	Forests under exploitation 3/: All types	Forests under exploitation 3/: Softwood	Forests under exploitation 3/: Hardwood	Growing stock (with bark) on areas under exploitation: All species	Growing stock: Softwood	Growing stock: Hardwood
	Million acres	Million acres	Percent	Million acres	Million acres	Million acres	Million acres	Billion cu. ft.	Billion cu. ft.	Billion cu. ft.
North America:										
United States	1,903	648	52	484	484	230	254	547	370	177
Alaska 4/	366	136	78	24	24	24	..	18	18	..
Canada 5/	2,218	951	75	370	190	142	48	255	199	56
Mexico	487	64	14	38	11	6	5	16	14	2
Total	4,974	1,799	65	916	709	402	307	836	601	235
Remainder of free world: 6/										
Latin America	5,046	2,135	3	775	194	24	170	284	35	249
Free Europe	249	270	60	263	258	157	101	275	179	96
Free Asia	2,393	1,054	11	661	485	32	453	718	31	687
Pacific Area	2,113	212	9	49	42	5	37	35	7	28
Africa	7,339	1,980	(7/)	702	267	5	262	283	4	279
Total	17,140	5,651	6	2,450	1,246	223	1,023	1,595	256	1,339
Total, Free World	22,114	7,450	20	3,366	1,955	625	1,330	2,431	857	1,574
U. S. S. R.	5,410	1,833	78	1,050	867	581	286	1,166	1,054	112
Other European Soviet countries 8/	935	66	52	66	63	33	30	75	40	35
Other Asiatic Soviet countries 9/	4,175	244	75	108	89	67	22	122	96	26
Total, Soviet Bloc	10,520	2,143	77	1,224	1,019	681	338	1,363	1,190	173
Total, World	32,634	9,593	33	4,590	2,974	1,306	1,668	3,794	2,047	1,747

1/ Source: World Forest Resources. Food and Agriculture Organization of the United Nations, Rome, Italy, pp. 1-120, illus. 1955. Data for North America revised to agree with statistics for individual countries given in other parts of this report.

2/ All forests that are now within reach of economic management or exploitation as sources of forest products, including immature forests and managed forests where fellings are prohibited.

3/ Forests yielding industrial wood and/or fuelwood.

4/ Combines coastal and interior Alaska.

5/ Excludes Labrador.

6/ For included countries see references cited in footnotes to table 8.

7/ Less than 0.5 percent.

8/ European U. S. S. R., Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland and Rumania.

9/ Asiatic U. S. S. R., China, Manuchuria, Tibet, North Korea, and Viet Minh.

Thus, with such a large share of softwood resources, North American countries and particularly the United States occupy a dominant position in the free world's timber economy. The United States alone has nearly 40 percent of the softwood area under exploitation in the free world. It stands first among the nations of the world as a producer of industrial timber products. Its output in 1952 was 60 percent greater than that of free Europe and more than 3 times that of Canada.

The bulk of the hardwood forests are in Latin America and Africa but these are not yet widely exploited.

North American and Free World Resources in Relation to Those of the World

The following tabulation and figure 12 give at a glance the relative distribution of the world's forest resources.

Distribution of World Forest Resources

	North America	Free World	Soviet Bloc
	Percent	Percent	Percent
Total forested area	19	78	22
Softwood types	37	48	52
Hardwood types	10	92	8
Forests under exploitation	22	66	34
Softwood types	31	48	52
Hardwood types	18	80	20
Timber volume1/	22	64	36
Softwood	30	42	58
Hardwood	13	90	10

1/ On forests under exploitation.

North America and the Soviet Bloc have about equal proportions of the forested area of the world. The free world has nearly four-fifths of the total. The free world also has about two-thirds of the forest area under exploitation and timber volume on such areas.

The softwood resources are largely confined to North America and the Soviet Bloc of countries. In comparison with North America and in fact the entire free world, the Soviet countries have a sizable margin in all softwood resource categories. With only 22 percent of the world forest area they control more than half of the softwood forest area and 58 percent of the softwood timber volume on areas under exploitation.

Softwoods are in great demand in most parts of the world and are generally in short supply, especially in free Europe. At the present rate of cutting the softwoods of free Europe could in all probability

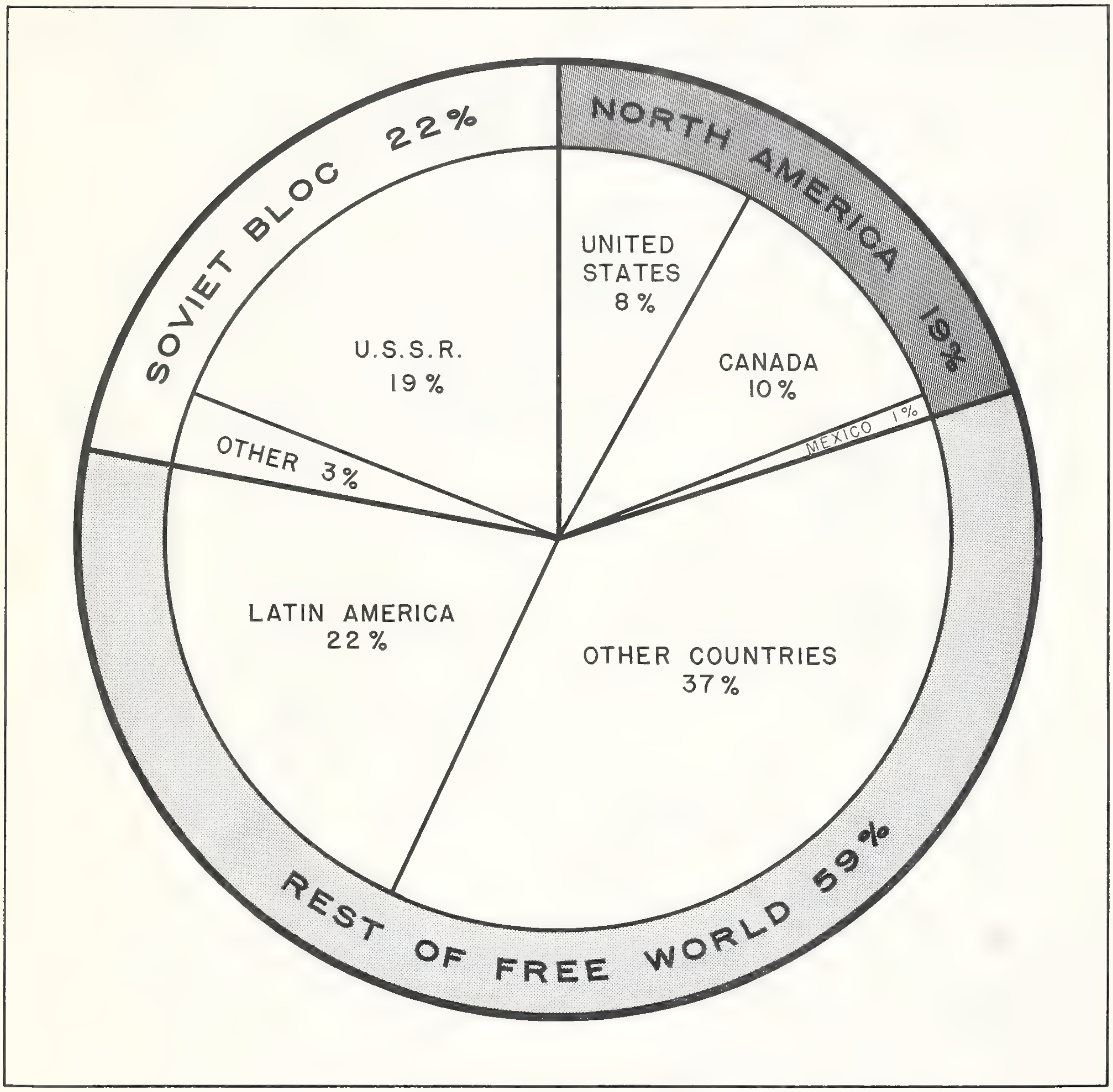

Fig. 12 - Forest land area of the world - 9.5 billion acres.

be fully utilized there and more too if additional supplies were forthcoming. The situation may be eased in time as more of the forest area is made accessible and as growing stock resources in countries depleted by war are built back to former levels. The free European softwood timber supply situation might also be considerably relieved if economic factors and government policy should permit a substantial resumption of imports from Soviet countries.

The United States appears to be in a favorable position to take care of its own needs but may lack any substantial margin for export. Canada, on the other hand, may well be able to considerably expand its exports to the United States and other countries since it has large untapped timber resources and as yet relatively little local demand.

The Soviet softwood resources are not yet being cut as heavily as those of the free world. With more than half of the softwood area and timber volume, the Soviet countries provide only 40 percent of the world's softwood timber cut. Before World War II Soviet countries, particularly European Russia, contributed substantially to international timber trade.

However, Soviet softwood resources are not likely to enter world trade on the scale that might be inferred from the statistics on their magnitude. Much of the Soviet Bloc softwood resource is situated in the very cold and relatively inaccessible north country. High costs of logging and transportation may keep a considerable part of this resource economically inaccessible for a long time. Furthermore, it is possible that the expanding economies of the Soviet countries will require most of the timber that can be economically harvested and processed.

All in all, despite the vast extent of Soviet softwood forests, it is unlikely that any substantial volume of Soviet timber would reach markets in the United States even though trade between the Soviet Bloc and free world countries were unrestricted. In any event timber products from the United States should be able to compete in other parts of the world with similar products from Soviet countries, should other factors favor an expansion of timber-products export from this country.

Regions and Sections used in the Timber Resource Review

TIMBER RESOURCE REVIEW

CHAPTER IX
APPENDICES

A. SUMMARY OF BASIC STATISTICS

(Preliminary Review Draft Subject To Revision)

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

CHAPTER IX. A P P E N D I C E S

A. SUMMARY OF BASIC STATISTICS

(Preliminary review draft subject to revision)

By:

George F. Burks

September, 1955

Of the 78 tables presented here, the first 19 give detailed statistics for individual States. The others contain basic statistics for regions and sections. In addition, various summaries of these are included in appropriate chapters of the report. Tables presenting statistics on ownership have not been brought together in one group but are in order according to subject matter, such as area, volume, protection, planting, and productivity of cutover lands.

State Tables

Table No. Page No.

Table 1.--Land area of the United States and Coastal Alaska, by major classes of land, and by section, region, and State, January 1, 1953 1/

(Comparable to Table 1, Basic Forest Statistics for the United States, January 1945, revised September 1950)

Section, region, and State	Total land area 2/	Forest land: Total	Forest land: Commercial	Forest land: Noncommercial: Total	Noncommercial: Productive but reserved	Noncommercial: Unproductive 3/: Total	Unproductive: Reserved	Unproductive: Unreserved	Cropland in farms 4/	Pasture and range 5/: Total	Pasture and range: In farms	Pasture and range: Not in farms	Other 6/
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
North:													
New England:													
Connecticut	3,135	1,990	1,973	17	11	6	..	6	369	286	286	..	490
Maine	19,866	17,088	16,601	487	164	323	23	300	1,186	494	494	..	1,098
Massachusetts	5,035	3,288	3,259	29	18	11	..	11	473	296	296	..	978
New Hampshire	5,771	4,848	4,682	166	25	141	62	79	349	250	250	..	324
Rhode Island	677	434	430	4	4	..	..	..	55	38	38	..	150
Vermont	5,938	3,730	3,713	17	10	7	..	7	937	971	971	..	300
Total	40,422	31,378	30,658	720	232	488	85	403	3,369	2,335	2,335	..	3,340
Middle Atlantic:													
Delaware	1,266	454	448	6	..	6	..	6	463	100	100	..	249
Maryland	1/ 6,363	2,920	2,897	23	20	3	..	3	1,838	798	798	..	1/ 807
New Jersey	4,814	1,958	1,910	48	17	31	..	31	930	286	286	..	1,640
New York	30,684	14,450	12,002	2,448	2,377	71	..	71	6,906	4,705	4,705	..	4,623
Pennsylvania	28,829	15,205	15,108	97	97	..	..	..	6,834	2,922	2,922	..	3,868
West Virginia	15,411	9,907	9,860	47	41	6	..	6	1,567	3,113	3,113	..	824
Total	87,367	44,894	42,225	2,669	2,552	117	..	117	18,538	11,924	11,924	..	12,011
Lake States:													
Michigan	36,494	19,322	18,849	473	272	201	5	196	9,061	3,084	3,084	..	5,027
Minnesota	51,206	19,344	18,098	1,246	428	818	7	811	20,901	4,178	4,178	..	6,783
Wisconsin	35,011	16,535	16,325	210	18	192	20	172	10,718	4,619	4,619	..	3,139
Total	122,711	55,201	53,272	1,929	718	1,211	32	1,179	40,680	11,881	11,881	..	14,949
Central:													
Illinois	35,798	3,993	3,938	55	46	9	..	9	21,351	4,856	4,856	..	5,598
Indiana	23,171	4,103	4,045	58	58	..	..	..	11,777	3,518	3,518	...	3,773
Iowa	35,869	2,510	2,505	5	5	..	..	..	22,905	6,875	6,875	..	3,579
Kentucky	25,513	11,497	11,446	51	51	..	..	..	6,336	6,961	6,961	..	719
Missouri	44,305	15,177	15,064	113	37	76	..	76	13,651	11,506	11,140	366	3,971
Ohio	26,240	5,446	5,396	50	50	..	..	..	11,330	5,111	5,111	..	4,353
Total	190,896	42,726	42,394	332	247	85	..	85	87,350	38,827	38,461	366	21,993
Plains:													
Kansas	52,549	1,668	1,664	4	4	..	..	..	27,919	22,362	17,784	4,578	600
Nebraska	49,064	1,482	1,480	2	2	..	..	..	22,377	24,605	22,815	1,790	600
North Dakota	44,836	433	414	19	3	16	..	16	26,693	11,670	10,525	1,145	6,040
Oklahoma (West)	34,382	4,302	650	3,652	10	3,642	..	3,642	12,428	14,233	13,234	999	3,419
South Dakota (East)	42,364	776	684	92	3	89	..	89	19,004	22,184	12,700	9,484	400
Texas (West)	150,005	26,000	600	25,400	4	25,396	41	25,355	29,405	83,173	75,173	8,000	11,427
Total	373,200	34,661	5,492	29,169	26	29,143	41	29,102	137.826	178,227	152,231	25,996	22,486
Total, North	814,596	208,860	174,041	34,819	3,775	31,044	158	30,886	287,763	243,194	216,832	26,362	74,779
South:													
South Atlantic:													
North Carolina	31,422	19,513	18,976	537	335	202	18	184	6,966	1,790	1,790	..	3,153
South Carolina	19,395	11,943	11,891	52	49	3	..	3	4,892	984	984	..	1,576
Virginia	25,532	15,832	15,285	547	284	263	21	242	4.225	3,943	3,943	..	1,532
Total	76,349	47,288	46,152	1,136	668	468	39	429	16,083	6,717	6,717	..	6,261
Southeast:													
Alabama	32,690	20,771	20,756	15	5	10	..	10	7,123	3,305	3,305	..	1,491
Florida	34,728	23,047	21,519	1,528	74	1,454	186	1,268	2,388	4,863	4,332	531	4,430
Georgia	37,429	24,057	23,969	88	18	70	..	70	9,214	2,458	2,458	..	1,700
Mississippi	30,239	16,473	16,440	33	33	..	..	..	7,368	3,884	3,884	..	2,514
Tennessee	26,750	12,558	12,301	257	257	..	..	..	7,064	4,513	4,513	..	2,615
Total	161,836	96,906	94,985	1,921	387	1,534	186	1,348	33,157	19,023	18,492	531	12,750
West Gulf:													
Arkansas	33,712	19,346	19,292	54	51	3	..	3	7,182	4,057	4,057	..	3,127
Louisiana	28,904	15,990	15,899	91	84	7	..	7	3,854	3,956	2,956	1,000	5,104
Oklahoma (East)	9,798	6,027	5,257	770	20	750	10	740	1,270	1,828	1,828	..	673
Texas (East)	18,643	11,708	11,703	5	5	..	..	..	1,923	3,787	3,787	..	1,225
Total	91,057	53,071	52,151	920	160	760	10	750	14,229	13,628	12,628	1,000	10,129
Total, South	329,242	197,265	193,288	3,977	1,215	2,762	235	2,527	63,469	39,368	37,837	1,531	29,140

Table 1.--Land area of the United States and Coastal Alaska, by major classes of land, and by section, region, and State, January 1, 1953[1] - Continued

(Comparable to Table 1, Basic Forest Statistics for the United States, January 1945, revised September 1950)

Section, region, and State	Total land area[2]	Forest land: Total	Forest land: Commercial	Noncommercial: Total	Noncommercial: Productive but reserved	Unproductive[3]: Total	Unproductive[3]: Reserved	Unproductive[3]: Unreserved	Cropland in farms[4]	Pasture and range[5]: Total	Pasture and range[5]: In farms	Pasture and range[5]: Not in farms	Other[6]
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
West:													
Pacific Northwest:													
D.-fir subregion	35,100	29,047	25,455	3,592	1,551	2,041	827	1,214	2,007	1,581	1,521	60	2,465
Pine subregion	69,284	25,082	19,910	5,172	688	4,484	556	3,928	9,567	33,547	15,634	17,913	1,088
Total	104,384	54,129	45,365	8,764	2,239	6,525	1,383	5,142	11,574	35,128	17,155	17,973	3,553
Oregon	61,641	30,261	25,875	4,386	960	3,426	370	3,056	4,568	25,372	10,634	14,738	1,440
Washington	42,743	23,868	19,490	4,378	1,279	3,099	1,013	2,086	7,006	9,756	6,521	3,235	2,113
Total	104,384	54,129	45,365	8,764	2,239	6,525	1,383	5,142	11,574	35,128	17,155	17,973	3,553
California	100,314	42,541	17,317	25,224	1,202	24,022	1,941	22,081	10,235	26,300	17,074	9,226	21,238
Northern Rocky Mtn.:													
Idaho	52,972	21,025	13,372	7,653	1,475	6,178	2,140	4,038	4,745	22,659	6,111	16,548	4,543
Montana	93,362	22,330	15,727	6,603	1,070	5,533	1,457	4,076	12,657	56,324	42,498	13,826	2,051
South Dakota (West)	6,619	1,393	1,266	127	15	112	18	94	818	4,321	3,321	1,000	87
Wyoming	62,404	10,513	3,475	7,038	1,958	5,080	835	4,245	2,712	48,234	27,513	20,721	945
Total	215,357	55,261	33,840	21,421	4,518	16,903	4,450	12,453	20,932	131,538	79,443	52,095	7,626
Southern Rocky Mtn.:													
Arizona	72,688	19,212	3,180	16,032	223	15,809	577	15,232	1,082	47,469	31,297	16,172	4,925
Colorado	66,510	20,834	8,451	12,383	544	11,839	767	11,072	11,028	32,757	20,633	12,124	1,891
Nevada	70,265	12,036	109	11,927	27	11,900	500	11,400	619	55,492	6,217	49,275	2,118
New Mexico	77,767	21,329	5,735	15,594	617	14,977	343	14,634	2,393	50,929	36,697	14,232	3,116
Utah	52,701	16,219	3,014	13,205	201	13,004	609	12,395	2,053	31,071	6,815	24,256	3,358
Total	339,931	89,630	20,489	69,141	1,612	67,529	2,796	64,733	17,175	217,718	101,659	116,059	15,408
Total, West	759,986	241,561	117,011	124,550	9,571	114,979	10,570	104,409	59,916	410,684	215,331	195,353	47,825
Continental U. S.	1,903,824	647,686	484,340	163,346	14,561	148,785	10,963	137,822	411,148	693,246	470,000	223,246	151,744
Coastal Alaska	35,519	16,508	4,269	12,239	183	12,056	701	11,355	3	91	81	10	18,917
All regions	1,939,343	664,194	488,609	175,585	14,744	160,841	11,664	149,177	411,151	693,337	470,061	223,256	170,661

1/ Prepared by Forest Service, U. S. Department of Agriculture.
2/ Source: 1950 Bureau of Census.
3/ Lands currently unproductive for timber, but includes land that may be currently productive for the management of grazing, watershed, recreation, or wildlife resources.
4/ Source: 1950 Census of Agriculture.
5/ Exclusive of that in forest land.
6/ Farmsteads, roads, powerlines, urban, etc.
7/ Includes District of Columbia, 39 thousand acres.

Table 2.--Commercial forest land area in the United States and Coastal Alaska, by stand-size class, and by section, region, and State, January 1, 1953[1]

(Comparable to Table 2, Basic Forest Statistics for the United States, January 1945, revised September 1950)

Section, region and State	Total		Sawtimber stands			Pole-timber stands	Seedling and sapling stands	Nonstocked and other areas
			Total	Old-growth[2]	Young growth			
	Thousand acres	Percent	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
North:								
New England:								
Connecticut	1,973	0.40	334	..	334	1,065	529	45
Maine	16,601	3.40	5,869	..	5,869	8,494	1,811	427
Massachusetts	3,259	.67	395	..	395	1,557	1,271	36
New Hampshire	4,682	.96	1,916	..	1,916	1,736	849	181
Rhode Island	430	.09	14	..	14	234	169	13
Vermont	3,713	.76	1,774	..	1,774	1,415	340	184
Total	30,658	6.28	10,302	..	10,302	14,501	4,969	886
Middle Atlantic:								
Delaware	448	.09	242	..	242	134	60	12
Maryland	2,897	.59	1,416	..	1,416	896	451	134
New Jersey	1,910	.39	174	..	174	906	733	97
New York	12,002	2.46	5,029	..	5,029	4,276	2,406	291
Pennsylvania	15,108	3.09	3,279	..	3,279	7,481	3,730	618
West Virginia	9,860	2.02	4,862	..	4,862	3,298	1,462	238
Total	42,225	8.64	15,002	..	15,002	16,991	8,842	1,390
Lake States:								
Michigan	18,849	3.86	2,556	..	2,556	5,411	7,668	3,214
Minnesota	18,098	3.70	2,017	..	2,017	5,281	6,317	4,483
Wisconsin	16,325	3.34	1,884	..	1,884	5,318	6,385	2,738
Total	53,272	10.90	6,457	..	6,457	16,010	20,370	10,435
Central:								
Illinois	3,938	.81	1,823	..	1,823	981	729	405
Indiana	4,045	.83	2,084	..	2,084	1,337	600	24
Iowa	2,505	.51	903	..	903	909	341	352
Kentucky	11,446	2.34	4,964	..	4,964	4,040	1,830	612
Missouri	15,064	3.08	2,033	..	2,033	6,477	4,778	1,776
Ohio	5,396	1.11	2,679	..	2,679	1,978	679	60
Total	42,394	8.68	14,486	..	14,486	15,722	8,957	3,229
Plains:								
Kansas	1,664	.35	632	..	632	680	188	164
Nebraska	1,480	.30	309	..	309	453	442	276
North Dakota	414	.08	96	..	96	127	153	38
Oklahoma (West)	650	.13	160	..	160	410	70	10
South Dakota (East)	684	.14	148	25	123	229	130	177
Texas (West)	600	.12	130	..	130	390	70	10
Total	5,492	1.12	1,475	25	1,450	2,289	1,053	675
Total, North	174,041	35.62	47,722	25	47,697	65,513	44,191	16,615
South:								
South Atlantic:								
North Carolina	18,976	3.89	6,337	..	6,337	7,141	4,826	672
South Carolina	11,891	2.43	4,999	..	4,999	3,065	3,092	735
Virginia	15,285	3.13	5,497	..	5,497	8,006	1,713	69
Total	46,152	9.45	16,833	..	16,833	18,212	9,631	1,476
Southeast:								
Alabama	20,756	4.25	6,091	..	6,091	10,912	3,503	250
Florida	21,519	4.40	3,223	..	3,223	3,541	5,603	9,152
Georgia	23,969	4.91	6,355	..	6,355	8,814	7,200	1,600
Mississippi	16,440	3.36	5,920	..	5,920	6,380	3,117	1,023
Tennessee	12,301	2.52	2,916	..	2,916	7,554	1,674	157
Total	94,985	19.44	24,505	..	24,505	37,201	21,097	12,182

Table 2.--Commercial forest land area in the United States and Coastal Alaska, by stand-size class, and by section, region, and States, January 1, 1953[1] - Continued

(Comparable to Table 2, Basic Forest Statistics for the United States, January 1945, revised September 1950)

Section, region, and State	Total		Sawtimber stands			Pole-timber stands	Seedling and sapling stands	Nonstocked and other areas
			Total	Old-growth[2]	Young growth			
	Thousand acres	Percent	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
South: - Continued								
West Gulf:								
Arkansas	19,292	3.95	6,604	..	6,604	9,364	3,043	281
Louisiana	15,899	3.25	7,176	..	7,176	4,814	2,120	1,789
Oklahoma (East)	5,257	1.07	1,304	..	1,304	2,774	1,098	81
Texas (East)	11,703	2.40	4,080	..	4,080	6,011	1,349	263
Total	52,151	10.67	19,164	..	19,164	22,963	7,610	2,414
Total, South	193,288	39.56	60,502	..	60,502	78,376	38,338	16,072
West:								
Pacific Northwest:								
Douglas-fir subregion	25,455	5.21	14,611	7,468	7,143	4,542	4,260	2,042
Pine subregion	19,910	4.07	14,065	9,910	4,155	3,968	1,227	650
Total	45,365	9.28	28,676	17,378	11,298	8,510	5,487	2,692
Oregon	25,875	5.30	17,954	11,581	6,373	3,946	2,534	1,441
Washington	19,490	3.98	10,722	5,797	4,925	4,564	2,953	1,251
Total	45,365	9.28	28,676	17,378	11,298	8,510	5,487	2,692
California	17,317	3.54	14,038	11,240	2,798	1,122	44	2,113
Northern Rocky Mountain:								
Idaho	13,372	2.74	6,922	3,695	3,227	3,610	1,453	1,387
Montana	15,727	3.22	5,683	3,943	1,740	6,330	2,402	1,312
South Dakota (West)	1,266	.26	655	174	481	297	253	61
Wyoming	3,475	.71	1,779	1,361	418	1,038	602	56
Total	33,840	6.93	15,039	9,173	5,866	11,275	4,710	2,816
Southern Rocky Mountain:								
Arizona	3,180	.65	2,855	1,787	1,068	200	60	65
Colorado	8,451	1.74	3,827	2,762	1,065	2,285	1,544	795
Nevada	109	.02	79	41	38	26	1	3
New Mexico	5,735	1.17	3,899	2,183	1,716	1,224	188	424
Utah	3,014	.62	1,979	1,466	513	877	146	12
Total	20,489	4.20	12,639	8,239	4,400	4,612	1,939	1,299
Total, West	117,011	23.95	70,392	46,030	24,362	25,519	12,180	8,920
Continental United States	484,340	99.13	178,616	46,055	132,561	169,408	94,709	41,607
Coastal Alaska	4,269	.87	4,092	3,954	138	75	75	27
All regions	488,609	100.00	182,708	50,009	132,699	169,483	94,784	41,634

1/ Prepared by Forest Service, U. S. Department of Agriculture.
2/ Because of scattered occurrence and very limited area, no estimates have been made of old-growth sawtimber in the North and South, except for eastern South Dakota.

Table 3.--Commercial forest land area in the United States and Coastal Alaska, by ownership class, and by section, region, and State, January 1, 1953[1/]

(Comparable to Table 5, Basic Forest Statistics for the United States January 1945, revised September 1950)

Section, region, and State	All ownerships	Federal ownership or trusteeship: Total	Federal: National forest	Federal: Indian[2/]	Federal: Bureau of land management[2/]	Federal: Other[2/]	State[2/]	County and municipal[2/]	Private: Total	Private: Farm	Private: Wood-using industries[3/]	Private: Other
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
North:												
New England:												
Connecticut	1,973	1	..	..	..	1	122	32	1,818	526	(4/)	1,292
Maine	16,601	90	51	..	..	39	41	51	16,419	2,232	6,617	7,570
Massachusetts	3,259	29	..	..	..	29	280	90	2,860	740	(4/)	2,120
New Hampshire	4,682	585	580	..	..	5	45	52	4,000	1,039	771	2,190
Rhode Island	430	(5/)	..	..	..	(5/)	13	13	404	79	..	325
Vermont	3,713	199	191	..	..	8	79	19	3,416	1,522	528	1,366
Total	30,658	904	822	..	..	82	580	257	28,917	6,138	8,178	14,601
Middle Atlantic:												
Delaware	448	1	..	..	..	1	10	2	435	217	124	94
Maryland	2,897	54	4	..	..	50	128	32	2,683	1,169	(4/)	1,514
New Jersey	1,910	1	..	..	..	1	130	50	1,729	320	(4/)	1,409
New York	12,002	98	..	..	..	98	714	83	11,107	3,473	1,172	6,462
Pennsylvania	15,108	492	454	..	..	38	2,580	157	11,879	3,424	442	8,013
West Virginia	9,860	895	881	..	..	14	83	4	8,878	3,197	270	5,411
Total	42,225	1,541	1,339	..	..	202	3,645	328	36,711	11,800	2,069	22,842
Lake States:												
Michigan	18,849	2,482	2,343	23	13	103	3,819	86	12,462	3,877	1,447	7,138
Minnesota	18,098	3,055	2,195	717	49	94	3,484	3,619	7,940	4,881	578	2,481
Wisconsin	16,325	2,003	1,357	379	5	262	444	2,447	11,431	6,426	1,014	3,991
Total	53,272	7,540	5,895	1,119	67	459	7,747	6,152	31,833	15,184	3,039	13,610
Central:												
Illinois	3,938	216	184	..	..	32	10	(5/)	3,712	3,050	(4/)	662
Indiana	4,045	172	112	..	..	60	109	2	3,762	2,878	(4/)	884
Iowa	2,505	23	3	1	..	19	13	6	2,463	2,321	..	142
Kentucky	11,446	672	455	..	..	217	53	(5/)	10,721	4,903	308	5,510
Missouri	15,064	1,461	1,339	..	1	121	156	(5/)	13,447	8,498	460	4,489
Ohio	5,396	88	88	..	..	(5/)	168	41	5,099	3,047	(4/)	2,052
Total	42,394	2,632	2,181	1	1	449	509	49	39,204	24,697	817	13,690
Plains:												
Kansas	1,664	1	..	..	..	1	..	..	1,663	1,160	..	503
Nebraska	1,480	37	30	7	..	..	24	(5/)	1,419	820	..	599
North Dakota	414	149	..	91	1	57	10	..	255	182	..	73
Oklahoma (West)	650	..	..	..	..	..	10	..	640	540	..	100
South Dakota (East)	684	290	15	270	3	2	21	..	373	373	..	..
Texas (West)	600	..	..	..	..	..	..	..	600	500	..	100
Total	5,492	477	45	368	4	60	65	(5/)	4,950	3,575	..	1,375
Total, North	174,041	13,094	10,282	1,488	72	1,252	12,546	6,786	141,615	61,394	14,103	66,118
South:												
South Atlantic:												
North Carolina	18,976	1,304	999	47	..	258	236	43	17,393	13,590	2,584	1,219
South Carolina	11,891	763	524	..	..	239	128	25	10,975	7,530	1,696	1,749
Virginia	15,285	1,417	1,260	..	..	157	86	14	13,768	8,848	1,334	3,586
Total	46,152	3,484	2,783	47	..	654	450	82	42,136	29,968	5,614	6,554
Southeast:												
Alabama	20,756	789	614	..	10	165	150	27	19,790	8,114	3,138	8,538
Florida	21,519	1,813	1,035	36	14	728	382	56	19,268	8,905	4,369	5,994
Georgia	23,969	1,557	641	..	..	916	102	23	22,287	15,854	4,246	2,187
Mississippi	16,440	1,245	1,036	10	4	195	54	419	14,722	6,958	2,602	5,162
Tennessee	12,301	833	566	..	..	267	329	10	11,129	6,126	1,088	3,915
Total	94,985	6,237	3,892	46	28	2,271	1,017	535	87,196	45,957	15,443	25,796
West Gulf:												
Arkansas	19,292	2,802	2,326	..	122	354	106	2	16,382	6,733	4,118	5,531
Louisiana	15,899	667	536	..	4	127	176	5	15,051	3,160	4,281	7,610
Oklahoma (East)	5,257	270	180	20	(5/)	70	79	(5/)	4,908	1,700	(4/)	3,208
Texas (East)	11,703	736	655	4	..	77	29	2	10,936	2,625	3,123	5,188
Total	52,151	4,475	3,697	24	126	628	390	9	47,277	14,218	12,466	20,593
Total, South	193,288	14,196	10,372	117	154	3,553	1,857	626	176,609	90,143	33,523	52,943

Table 3.--Commercial forest land in the United States and Coastal Alaska, by ownership class, and by section, region, and State, January 1, 1953[1/] - Continued

(Comparable to Table 5, Basic Forest Statistics for the United States January 1945, revised September 1950)

Section, region, and State	All ownerships	Federal ownership or trusteeship: Total	Federal: National forest	Federal: Indian[2/]	Federal: Bureau of land management[2/]	Federal: Other[2/]	State[2/]	County and municipal[2/]	Private: Total	Private: Farm	Private: Wood-using industries[3/]	Private: Other
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
West:												
Pacific Northwest:												
D.-fir subregion	25,455	9,707	7,139	257	2,256	55	1,971	452	13,325	3,001	6,954	3,370
Pine subregion	19,910	12,943	9,970	2,506	404	63	665	53	6,249	2,343	1,926	1,980
Total	45,365	22,650	17,109	2,763	2,660	118	2,636	505	19,574	5,344	8,880	5,350
Oregon	25,875	15,067	11,435	1,148	2,481	3	758	282	9,768	3,458	4,733	1,577
Washington	19,490	7,583	5,674	1,615	179	115	1,878	223	9,806	1,886	4,147	3,773
Total	45,365	22,650	17,109	2,763	2,660	118	2,636	505	19,574	5,344	8,880	5,350
California	17,317	9,070	8,573	133	324	40	186	8	8,053	1,586	3,389	3,078
Northern Rocky Mtn:												
Idaho	13,372	9,579	9,174	74	331	..	826	(5/)	2,967	1,166	1,180	621
Montana	15,727	10,187	8,939	602	577	69	608	75	4,857	2,360	1,086	1,411
South Dakota (West)	1,266	980	972	..	6	2	61	2	223	150	(4/)	73
Wyoming	3,475	2,992	2,542	146	292	12	69	2	412	325	(4/)	87
Total	33,840	23,738	21,627	822	1,206	83	1,564	79	8,459	4,001	2,331	2,127
Southern Rocky Mtn:												
Arizona	3,180	3,021	2,201	815	5	..	34	..	125	46	(4/)	79
Colorado	8,451	6,668	6,262	26	368	12	132	38	1,613	994	..	619
Nevada	109	32	30	..	2	..	..	..	77	11	(4/)	66
New Mexico	5,735	3,839	2,993	712	90	44	158	5	1,733	1,355	136	242
Utah	3,014	2,566	1,865	69	632	..	56	..	392	343	(4/)	49
Total	20,489	16,126	13,351	1,622	1,097	56	380	43	3,940	2,749	156	1,935
Total, West	117,011	71,584	60,660	5,340	5,287	297	4,766	635	40,026	13,680	14,756	11,590
Continental U. S.	484,340	98,874	81,314	6,945	5,513	5,102	19,169	8,047	358,250	165,217	62,382	130,651
Coastal Alaska	4,269	4,250	3,445	20	785	..	..	..	19	..	..	19
All regions	488,609	103,124	84,759	6,965	6,298	5,102	19,169	8,047	358,269	165,217	62,382	130,670

1/ Prepared by Forest Service, U. S. Department of Agriculture.

2/ Because of different definitions of commercial forest land adopted by the Forest Service and other public agencies, acreage figures for these ownerships may vary from actual published commercial forest land acreages of the public agencies concerned.

3/ Includes lumber, pulp, and other wood-manufacturing industries.

4/ Included with "Other private" to avoid possible disclosure of commercial forest land area owned by individual wood-using industries in particular States. In regions where these combinations have been made, State figures for wood-using industries and "Other private" do not add to regional totals that give the proper ownership distribution on a regional basis. Sectional and national totals also show correct ownership distribution. In all other cases State figures are in agreement with regional totals.

5/ Less than 0.5 thousand acres.

Table 4.--Commercial forest land area in private ownership in the United States and Coastal Alaska, and number of private owners, by size class of owner and by State, 1953[1]

State	All classes		Under 100 acres		100 to 500 acres		500 to 5,000 acres		5,000 to 50,000 acres		50,000 acres and larger	
	Area	Number of owners	Area	Number of owners[2]	Area	Number of owners	Area	Number of owners	Area	Number of owners	Area	Number of owners
	Thousand acres		Thousand acres		Thousand acres		Thousand acres		Thousand acres		Thousand acres	
Alabama	19,790	169,821	5,504	132,203	6,169	34,872	2,928	2,508	2,639	218	2,550	20
Arizona	125	458	13	331	21	106	91	21	..	..	(3/)	(3/)
Arkansas	16,382	160,957	4,457	124,300	4,714	32,830	2,671	3,720	1,427	93	3,113	14
California	8,053	10,464	301	5,337	1,022	3,971	1,293	999	2,297	141	3,140	16
Colorado	1,613	4,333	156	1,677	441	1,925	661	722	355	9	(4/)	(4/)
Connecticut	1,818	45,719	986	40,614	717	5,063	68	38	47	4	..	..
Delaware	435	7,576	185	6,379	219	1,171	31	26	(3/)	(3/)	..	..
Florida	19,268	93,583	2,103	67,195	3,619	21,344	3,840	4,743	3,841	270	5,865	31
Georgia	22,287	196,665	5,047	145,760	7,512	47,136	4,675	3,552	2,578	204	2,475	13
Idaho	2,967	10,831	288	5,489	774	4,838	720	479	346	20	839	5
Illinois	3,712	131,101	2,684	126,397	991	4,646	37	58	..	..	..	..
Indiana	3,762	126,190	3,219	123,118	485	3,047	15	20	43	5	..	..
Iowa	2,463	34,738	2,060	33,749	403	989	..	..	..	..	..	..
Kansas	1,663	57,514	1,473	56,654	190	860	..	..	..	..	..	..
Kentucky	10,721	243,488	5,249	214,687	3,312	25,805	1,616	2,954	544	42	(4/)	(4/)
Louisiana	15,051	111,654	2,987	91,979	3,260	17,914	1,923	1,583	2,665	145	4,216	33
Maine	16,419	77,479	3,134	62,557	2,120	14,265	586	528	1,480	101	9,099	28
Maryland	2,683	39,544	1,271	33,544	1,229	5,829	110	164	73	7	..	..
Massachusetts	2,860	29,758	1,214	25,175	1,262	4,316	301	262	83	5	..	..
Michigan	12,462	174,422	5,301	158,702	3,018	15,041	562	610	941	55	2,640	14
Minnesota	7,940	140,562	4,168	123,431	2,699	16,564	329	548	744	19	(4/)	(4/)
Mississippi	14,722	133,394	3,822	103,444	4,490	27,500	3,156	2,348	1,498	90	1,756	12
Missouri	13,447	201,025	6,331	175,343	4,782	24,596	1,630	1,054	704	32	(4/)	(4/)
Montana	4,857	14,536	295	7,374	840	5,471	1,625	1,671	222	16	1,875	4
Nebraska	1,419	53,831	1,397	53,731	22	100	..	..	..	..	..	..
Nevada	77	180	4	82	15	68	58	30	(3/)	(3/)	...	..
New Hampshire	4,000	49,373	1,125	35,401	1,672	13,463	492	482	711	27	(4/)	(4/)
New Jersey	1,729	27,150	623	24,920	215	1,272	746	952	145	6	(4/)	(4/)
New Mexico	1,733	2,037	32	718	235	1,076	328	196	453	40	685	7
New York	11,107	254,942	6,194	238,231	2,305	15,470	901	1,174	843	59	864	8
North Carolina	17,393	267,056	7,105	231,565	5,745	34,080	1,727	1,294	1,269	108	1,547	9
North Dakota	255	8,500	255	8,500	..	..	..	..	..	..	..	..
Ohio	5,099	149,529	3,383	141,228	1,420	8,150	183	143	113	8	..	..
Oklahoma	5,548	82,033	2,213	71,875	1,699	9,541	462	582	1,174	35	(4/)	(4/)
Oregon	9,768	36,253	869	23,921	2,010	10,273	2,144	1,917	2,129	127	2,616	15
Pennsylvania	11,879	301,604	6,715	277,563	3,159	22,710	852	1,261	830	65	323	5
Rhode Island	404	12,330	209	11,110	155	1,190	40	30	..	..	..	..
South Carolina	10,975	116,215	3,117	88,795	3,959	24,965	1,551	2,355	1,080	91	1,268	9
South Dakota	596	17,963	408	17,602	143	353	45	8	(3/)	(3/)	..	..
Tennessee	11,129	185,133	4,618	164,929	2,955	19,065	1,543	1,021	1,514	111	499	7
Texas	11,536	119,707	3,050	96,379	3,360	22,445	1,008	788	1,042	79	3,076	16
Utah	392	748	21	329	40	226	248	184	83	9	..	..
Vermont	3,416	39,912	1,232	29,257	1,569	10,557	94	70	521	28	(4/)	(4/)
Virginia	13,768	211,187	4,928	176,996	5,178	31,643	2,217	2,472	740	69	705	7
Washington	9,806	47,667	1,323	35,920	2,206	10,547	1,402	1,118	861	64	4,014	18
West Virginia	8,878	133,571	3,617	120,126	2,240	12,660	574	673	1,596	102	851	10
Wisconsin	11,431	176,906	6,304	159,776	3,213	16,250	786	852	465	22	663	6
Wyoming	412	802	23	454	69	224	320	124	(3/)	(3/)	..	..
Coastal Alaska	19	286	10	246	9	40	..	..	..	..	..	..

1/ Prepared by Forest Service, U. S. Department of Agriculture. The determination of size class of ownership was based on the total commercial forest land in the ownership within the State.

2/ Includes ownerships containing 3 to 100 acres of commercial forest land in the East and 10 to 100 acres in the West.

3/ Included in the 500 to 5,000 acre size class in order to avoid possible disclosure of individual owners.

4/ Included in the 5,000 to 50,000 acre size class in order to avoid possible disclosure of individual owners.

Table 5.--Commercial forest land area in private ownership in the United States and Coastal Alaska and number of private owners by type of ownership and by State, 1953[1/]

State	All ownerships		Farm		All wood manufacturers		Other private	
	Area	Number of owners	Area	Number of owners	Area	Number of owners	Area	Number of owners
	Thousand acres		Thousand acres		Thousand acres		Thousand acres	
Alabama	19,790	169,821	8,114	131,057	3,138	1,522	8,538	37,242
Arizona	125	458	46	287	2	8	77	163
Arkansas	16,382	160,957	6,733	123,184	4,118	760	5,531	37,013
California	8,053	10,464	1,586	2,675	3,389	385	3,078	7,404
Colorado	1,613	4,333	994	2,168	..	..	619	2,165
Connecticut	1,818	45,719	526	11,096	3	108	1,289	34,515
Delaware	435	7,576	217	6,543	124	173	94	860
Florida	19,268	93,583	8,905	52,821	4,369	581	5,994	40,181
Georgia	22,287	196,665	15,854	172,314	4,246	1,434	2,187	22,917
Idaho	2,967	10,831	1,166	4,669	1,180	18	621	6,144
Illinois	3,712	131,101	3,050	116,467	10	633	652	14,001
Indiana	3,762	126,190	2,878	108,319	9	184	875	17,687
Iowa	2,463	34,738	2,321	31,078	..	..	142	3,660
Kansas	1,663	57,514	1,160	56,962	..	..	503	552
Kentucky	10,721	243,488	4,903	207,916	308	1,329	5,510	34,243
Louisiana	15,051	111,654	3,160	58,088	4,281	406	7,610	53,160
Maine	16,419	77,479	2,232	30,401	6,617	580	7,570	46,498
Maryland	2,683	39,544	1,169	29,695	57	4	1,457	9,845
Massachusetts	2,860	29,758	740	8,697	259	134	1,861	20,927
Michigan	12,462	174,422	3,877	126,642	1,447	208	7,138	47,572
Minnesota	7,940	140,562	4,881	101,298	578	375	2,481	38,889
Mississippi	14,722	133,394	6,958	100,712	2,602	594	5,162	32,088
Missouri	13,447	201,025	8,498	168,435	460	608	4,489	31,982
Montana	4,857	14,536	2,360	4,930	1,086	4	1,411	9,602
Nebraska	1,419	53,831	820	53,831	..	..	599	(3/)
Nevada	77	180	11	40	13	11	53	129
New Hampshire	4,000	49,373	1,039	15,397	771	752	2,190	33,224
New Jersey	1,729	27,150	320	11,837	(2/)	(2/)	1,409	15,313
New Mexico	1,733	2,037	1,355	1,789	136	8	242	240
New York	11,107	254,942	3,473	167,731	1,172	1,196	6,462	86,015
North Carolina	17,393	267,056	13,590	222,110	2,584	1,959	1,219	42,987
North Dakota	255	8,500	182	8,500	..	..	73	(3/)
Ohio	5,099	149,529	3,047	134,406	30	287	2,022	14,836
Oklahoma	5,548	82,033	2,240	52,154	944	15	2,364	29,864
Oregon	9,768	36,253	3,458	22,835	4,733	1,236	1,577	12,182
Pennsylvania	11,879	301,604	3,424	229,620	442	1,271	8,013	70,713
Rhode Island	404	12,330	79	2,846	..	..	325	9,484
South Carolina	10,975	116,215	7,530	103,438	1,696	732	1,749	12,045
South Dakota	596	17,963	523	17,786	6	..	67	177
Tennessee	11,129	185,133	6,126	160,174	1,088	302	3,915	24,657
Texas	11,536	119,707	3,125	81,389	3,123	2,629	5,288	35,689
Utah	392	748	343	551	5	6	44	191
Vermont	3,416	39,912	1,522	25,833	528	473	1,366	13,606
Virginia	13,768	211,187	8,848	149,316	1,334	1,271	3,586	60,600
Washington	9,806	47,667	1,886	22,574	4,147	743	3,773	24,350
West Virginia	8,878	133,571	3,197	97,906	270	282	5,411	35,383
Wisconsin	11,431	176,906	6,426	143,389	1,014	229	3,991	33,288
Wyoming	412	802	325	596	(2/)	(2/)	87	206
Coastal Alaska	19	286	..	..	..	..	19	286

1/ Prepared by Forest Service, U. S. Department of Agriculture.
2/ Included with other private to avoid possible disclosure of individual ownership.
3/ Number of owners not estimated because of insufficient sampling.

Table 6.--Net volume of live sawtimber in sawtimber stands and other stands, and net volume of salvable dead sawtimber, on commercial forest land in the United States and Coastal Alaska, by softwoods and hardwoods, and by section, region, and State, January 1, 1953[1]

(Comparable to Table 3, Basic Forest Statistics for the United States January 1945, revised September 1950)

Section, region, and State	Live sawtimber: Total: All species		Total: Softwood	Total: Hardwood	Sawtimber stands: Total	Sawtimber stands: Softwood	Sawtimber stands: Hardwood	Other stands[2]: Total	Other stands[2]: Softwood	Other stands[2]: Hardwood	Salvable dead sawtimber: Total	Salvable dead sawtimber: Softwood	Salvable dead sawtimber: Hardwood
	Million bd. ft.	Percent	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
North:													
New England:													
Connecticut	1,859	0.09	263	1,596	1,068	170	898	791	93	698	..	..	..
Maine	28,226	1.37	16,898	11,328	24,839	14,870	9,969	3,387	2,028	1,359	..	..	..
Massachusetts	2,659	.13	1,299	1,360	1,411	714	697	1,248	585	663	..	..	..
New Hampshire	10,069	.49	5,527	4,542	8,446	4,858	3,588	1,623	669	954	..	..	..
Rhode Island	165	.01	29	136	40	6	34	125	23	102	..	..	..
Vermont	8,547	.42	3,153	5,394	7,538	2,759	4,779	1,009	394	615	..	..	..
Total	51,525	2.51	27,169	24,356	43,342	23,377	19,965	8,183	3,792	4,391	..	..	..
Middle Atlantic:													
Delaware	1,234	.06	518	716	1,120	472	648	114	46	68	..	..	..
Maryland	6,771	.33	1,526	5,245	6,202	1,398	4,804	569	128	441	40	..	40
New Jersey	1,660	.08	351	1,309	684	111	573	976	240	736	..	..	..
New York	26,883	1.31	6,517	20,366	23,048	5,676	17,372	3,835	841	2,994	..	..	..
Pennsylvania	19,306	.94	2,881	16,425	13,167	1,865	11,302	6,139	1,016	5,123	..	..	..
West Virginia	18,497	.89	1,535	16,962	16,217	1,285	14,932	2,280	250	2,030	1,328	..	1,328
Total	74,351	3.61	13,328	61,023	60,438	10,807	49,631	13,913	2,521	11,392	1,368	..	1,368
Lake States:													
Michigan	21,141	1.03	5,469	15,672	13,411	2,930	10,481	7,730	2,539	5,191	29	9	20
Minnesota	12,538	.61	5,039	7,499	7,735	2,531	5,204	4,803	2,508	2,295	14	8	6
Wisconsin	16,111	.78	3,847	12,264	9,838	2,282	7,556	6,273	1,565	4,708	26	7	19
Total	49,790	2.42	14,355	35,435	30,984	7,743	23,241	18,806	6,612	12,194	69	24	45
Central:													
Illinois	11,694	.57	44	11,650	10,311	43	10,268	1,383	1	1,382	..	..	..
Indiana	11,671	.57	54	11,617	10,750	44	10,706	921	10	911	..	..	..
Iowa	4,119	.20	..	4,119	3,374	..	3,374	745	..	745	..	..	..
Kentucky	27,342	1.33	2,167	25,175	23,630	1,791	21,839	3,712	376	3,336	481	..	[3] 481
Missouri	13,195	.64	809	12,386	6,406	518	5,888	6,789	291	6,498	..	..	..
Ohio	14,650	.71	346	14,304	13,127	275	12,852	1,523	71	1,452	32	..	[3] 32
Total	82,671	4.02	3,420	79,251	67,598	2,671	64,927	15,073	749	14,324	513	..	513
Plains:													
Kansas	3,371	.16	6	3,365	3,019	..	3,019	352	6	346	..	..	..
Nebraska	1,253	.06	187	1,066	1,170	157	1,013	83	30	53	..	..	..
North Dakota	653	.03	..	653	586	..	586	67	..	67	1	..	1
Oklahoma (West)	880	.04	..	880	530	..	530	350	..	350	4	..	4
S. Dakota (East)	790	.04	107	683	611	101	510	179	6	173	30	2	28
Texas (West)	730	.04	370	360	480	260	220	250	110	140	4	2	2
Total	7,677	.37	670	7,007	6,396	518	5,878	1,281	152	1,129	39	4	35
Total, North	266,014	12.93	58,942	207,072	208,758	45,116	163,642	57,256	13,826	43,430	1,989	28	1,961
South:													
South Atlantic:													
North Carolina	44,152	2.15	22,459	21,693	33,535	17,315	16,220	10,617	5,144	5,473	[4] 45	3	[4] 42
South Carolina	32,299	1.57	18,876	13,423	28,085	16,096	11,989	4,214	2,780	1,434	6	5	1
Virginia	30,407	1.48	9,809	20,598	21,982	6,747	15,235	8,425	3,062	5,363	[5] 27	1	[5] 26
Total	106,858	5.20	51,144	55,714	83,602	40,158	43,444	23,256	10,986	12,270	78	9	69
Southeast:													
Alabama	38,211	1.86	21,929	16,282	28,134	16,912	11,222	10,077	5,017	5,060	231	118	113
Florida	23,032	1.12	18,064	4,968	14,990	11,253	3,737	8,042	6,811	1,231	5	4	1
Georgia	36,920	1.79	23,112	13,808	25,735	15,944	9,791	11,185	7,168	4,017	[6] 21	8	[6] 13
Mississippi	25,789	1.25	11,138	14,651	21,026	9,274	11,752	4,763	1,864	2,899	185	67	118
Tennessee	15,350	.75	2,590	12,760	9,770	1,792	7,978	5,580	798	4,782	220	18	202
Total	139,302	6.77	76,833	62,469	99,655	55,175	44,480	39,647	21,658	17,989	[6] 662	215	[6] 447
West Gulf:													
Arkansas	38,317	1.86	17,777	20,540	29,269	15,359	13,910	9,048	2,418	6,630	184	78	106
Louisiana	41,436	2.01	18,208	23,228	35,602	16,016	19,586	5,834	2,192	3,642	159	78	81
Oklahoma (East)	5,580	.27	2,230	3,350	3,620	1,740	1,880	1,960	490	1,470	28	10	18
Texas (East)	25,575	1.25	16,741	8,834	19,593	14,076	5,517	5,982	2,665	3,317	93	60	33
Total	110,908	5.39	54,956	55,952	88,084	47,191	40,893	22,824	7,765	15,059	464	226	238
Total, South	357,068	17.36	182,933	174,135	271,341	142,524	128,817	85,727	40,409	45,318	1,204	450	754

Table 6.--Net volume of live sawtimber in sawtimber stands and other stands, and net volume of salvable dead sawtimber, on commercial forest land in the United States and Coastal Alaska, by softwoods and hardwoods, and by section, region, and State, January 1, 1953[1/] - Continued

(Comparable to Table 3, Basic Forest Statistics for the United States January 1945, revised September 1950)

Section, region, and State	Live sawtimber: Total: All species		Live sawtimber: Total: Softwood	Live sawtimber: Total: Hardwood	Live sawtimber: Sawtimber stands: Total	Live sawtimber: Sawtimber stands: Softwood	Live sawtimber: Sawtimber stands: Hardwood	Live sawtimber: Other stands[2/]: Total	Live sawtimber: Other stands[2/]: Softwood	Live sawtimber: Other stands[2/]: Hardwood	Salvable dead sawtimber: Total	Salvable dead sawtimber: Softwood	Salvable dead sawtimber: Hardwood
	Million bd. ft.	Percent	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
West:													
Pacific Northwest:													
D.-fir subregion	594,375	28.90	577,116	17,259	572,799	556,152	16,647	21,576	20,964	612	23,446	23,367	79
Pine subregion	154,501	7.51	154,317	184	147,491	147,344	147	7,010	6,973	37	2,469	2,469	..
Total	748,876	36.41	731,433	17,443	720,290	703,496	16,794	28,586	27,937	649	25,915	25,836	79
Oregon	433,809	21.09	424,721	9,088	418,872	410,101	8,771	14,937	14,620	317	17,015	16,974	41
Washington	315,067	15.32	306,712	8,355	301,418	293,395	8,023	13,649	13,317	332	8,900	8,862	38
Total	748,876	36.41	731,433	17,443	720,290	703,496	16,794	28,586	27,937	649	25,915	25,836	79
California	360,001	17.50	354,024	5,977	351,477	346,359	5,118	8,524	7,665	859	1,570	1,570	(7/)
Northern Rocky Mtn:													
Idaho	96,015	4.67	95,809	206	92,621	92,421	200	3,394	3,388	6	2,693	2,692	1
Montana	55,770	2.71	55,075	695	45,916	45,309	607	9,854	9,766	88	1,209	1,209	..
S. Dakota (West)	3,167	.15	3,167	..	2,983	2,983	..	184	184	..	89	89	..
Wyoming	12,070	.59	11,631	439	11,296	11,177	119	774	454	320	289	269	20
Total	167,022	8.12	165,682	1,340	152,816	151,890	926	14,206	13,792	414	4,280	4,259	21
Southern Rocky Mtn:													
Arizona	19,988	.97	19,817	171	19,790	19,628	162	198	189	9	387	386	1
Colorado	25,394	1.23	23,777	1,617	22,819	21,504	1,315	2,575	2,273	302	1,217	1,200	17
Nevada	572	.03	565	7	549	546	3	23	19	4	1	1	..
New Mexico	15,054	.73	14,038	1,016	14,144	13,304	840	910	734	176	192	189	3
Utah	7,800	.39	7,392	408	7,531	7,133	398	269	259	10	440	353	87
Total	68,808	3.35	65,589	3,219	64,833	62,115	2,718	3,975	3,474	501	2,237	2,129	108
Total, West	1,344,707	65.38	1,316,728	27,979	1,289,416	1,263,860	25,556	55,291	52,868	2,423	34,002	33,794	208
Continental U. S.	1,967,789	95.67	1,558,603	409,186	1,769,515	1,451,500	318,015	198,274	107,103	91,171	37,195	34,272	2,923
Coastal Alaska	89,058	4.33	88,951	107	88,533	88,427	106	525	524	1	320	320	..
All regions	2,056,847	100.00	1,647,554	409,293	1,858,048	1,539,927	318,121	198,799	107,627	91,172	37,515	34,592	2,923

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net volume in board feet log scale, International 1/4-inch rule.
2/ Poletimber and seedling and sapling stands and nonstocked and other areas.
3/ Dead chestnut.
4/ Includes 41 million board feet of dead chestnut.
5/ Includes 25 million board feet of dead chestnut.
6/ Includes 9 million board feet of dead chestnut.
7/ Less than 0.5 million board feet.

Table 7.--Net volume of live sawtimber on commercial forest land in the United States and Coastal Alaska by species group, and by section, region, and State, January 1, 1953[1/]

(Comparable to Table 10, Basic Forest Statistics for the United States January 1945, revised September 1950)

EASTERN SOFTWOODS

Section, region, and State	Total	White and red pine	Jack pine	Longleaf and slash pine	Shortleaf and loblolly pine	Spruce and balsam fir	Hemlock	Cypress	Other
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
North:									
New England:									
Connecticut	263	71	..	..	..	..	184	..	8
Maine	16,898	3,082	..	..	..	11,562	1,149	..	1,105
Massachusetts	1,299	858	1	..	..	24	381	..	35
New Hampshire	5,527	3,029	..	..	..	1,255	1,111	..	132
Rhode Island	29	26	..	..	..	..	..	..	3
Vermont	3,153	536	..	..	..	1,599	924	..	94
Total	27,169	7,602	1	..	..	14,440	3,749	..	1,377
Middle Atlantic:									
Delaware	518	..	..	..	443	..	..	..	75
Maryland	1,526	32	..	..	1,061	..	..	..	433
New Jersey	351	..	..	..	62	..	9	..	280
New York	6,517	2,287	20	..	..	1,655	2,314	..	241
Pennsylvania	2,881	980	..	..	..	18	1,345	..	538
West Virginia	1,535	278	..	..	159	264	344	..	490
Total	13,328	3,577	20	..	1,725	1,937	4,012	..	2,057
Lake States:									
Michigan	5,469	1,504	308	..	..	1,076	1,695	..	886
Minnesota	5,039	1,716	1,421	..	..	1,340	..	..	562
Wisconsin	3,847	1,795	354	..	..	281	1,040	..	377
Total	14,355	5,015	2,083	..	..	2,697	2,735	..	1,825
Central:									
Illinois	44	..	..	..	..	..	..	21	23
Indiana	54	..	..	..	42	..	..	2	10
Iowa	..	..	..	..	..	..	..	..	..
Kentucky	2,167	68	..	..	1,085	..	320	42	652
Missouri	809	..	..	..	536	..	..	215	58
Ohio	346	..	..	..	234	..	112	..	..
Total	3,420	68	..	..	1,897	..	432	280	743
Plains:									
Kansas	6	..	..	..	..	..	..	..	2/ 6
Nebraska	187	..	..	..	..	..	..	..	187
North Dakota	..	..	..	..	..	..	..	..	..
Oklahoma (West)	..	..	..	..	..	..	..	..	2/ ..
South Dakota (East)	107	..	..	..	..	..	..	..	107
Texas (West)	370	..	..	..	370	..	..	(3/)	(3/)
Total	670	..	..	..	370	..	..	(3/)	300
Total North	58,942	16,262	2,104	..	3,992	19,074	10,928	280	6,302
South:									
South Atlantic:									
North Carolina	22,459	257	..	721	16,853	10	711	1,216	2,691
South Carolina	18,876	15	..	2,463	13,621	..	29	1,162	1,586
Virginia	9,809	465	..	..	6,494	..	373	383	2,094
Total	51,144	737	..	3,184	36,968	10	1,113	2,761	6,371
Southeast:									
Alabama	21,929	..	..	5,151	15,297	..	19	416	1,046
Florida	18,064	..	..	12,551	1,518	..	..	3,178	817
Georgia	23,112	121	..	11,052	9,532	..	49	1,566	792
Mississippi	11,138	..	..	2,329	7,666	..	..	722	421
Tennessee	2,590	210	..	..	1,065	..	224	215	876
Total	76,833	331	..	31,083	35,078	..	292	6,097	3,952
West Gulf:									
Arkansas	17,777	..	..	..	16,978	..	..	775	24
Louisiana	18,208	..	..	1,153	14,337	..	..	2,410	308
Oklahoma (East)	2,230	..	..	..	2,223	..	..	4	3
Texas (East)	16,741	..	..	1,218	15,168	..	..	355	..
Total	54,956	..	..	2,371	48,706	..	..	3,544	335
Total South	182,933	1,068	..	36,638	120,752	10	1,405	12,402	10,658
Total Eastern United States	241,875	17,330	2,104	36,638	124,744	19,084	12,333	12,682	16,960

See footnotes at end of table.

Table 7.--Net volume of live sawtimber on commercial forest land in the United States and Coastal Alaska by species group, and by section, region, and State, January 1, 1953[1]--Continued

(Comparable to Table 10, Basic Forest Statistics for the United States January 1945, revised September 1950)

EASTERN HARDWOODS

Section, region, and State	Total	White oak[4]	Red oak[5]	Other oaks	Yellow birch and sugar maple	Soft maple and beech	Sweetgum	Tupelo and blackgum	Hickory	Yellow-poplar	Ash, basswood and black walnut	Cottonwood and aspen	Other
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
North:													
New England:													
Connecticut	1,596	260	503	244	134	202	..	2	79	97	31	..	44
Maine	11,328	..	173	..	6,226	335	..	..	..	..	52	252	4,290
Massachusetts	1,360	90	405	113	243	242	..	..	6	10	122	2	127
New Hampshire	4,542	45	372	..	2,422	1,072	..	..	..	..	145	18	468
Rhode Island	136	28	46	29	2	18	..	1	8	..	4	..	..
Vermont	5,394	..	210	..	3,112	1,284	..	..	..	..	113	76	599
Total	24,356	423	1,709	386	12,139	3,153	..	3	93	107	467	348	5,528
Middle Atlantic:													
Delaware	716	218	185	..	..	92	128	8	22	37	2	..	24
Maryland	5,245	1,002	708	729	..	472	608	168	226	965	..	..	367
New Jersey	1,309	258	470	..	72	161	131	22	40	76	44	2	33
New York	20,366	855	1,629	143	7,596	5,010	..	..	265	102	1,996	265	2,505
Pennsylvania	16,425	1,748	3,579	2,837	1,357	2,572	16	83	441	634	873	42	2,243
West Virginia	16,962	2,782	3,607	1,583	2,188	2,171	..	373	1,052	1,221	849	..	1,136
Total	61,023	6,863	10,178	5,292	11,213	10,478	883	654	2,046	3,035	3,764	309	6,308
Lake States:													
Michigan	15,672	784	1,337	722	5,099	2,241	..	..	119	..	1,140	1,234	2,996
Minnesota	7,499	174	1,218	540	314	104	..	..	9	..	1,308	1,927	1,905
Wisconsin	12,264	1,007	3,045	667	2,557	770	..	..	22	..	1,763	797	1,636
Total	35,435	1,965	5,600	1,929	7,970	3,115	..	..	150	..	4,211	3,958	6,537
Central:													
Illinois	11,650	2,399	1,172	3,022	262	782	135	36	789	161	540	336	2,016
Indiana	11,617	1,375	1,044	2,094	908	1,226	171	130	929	614	925	162	2,039
Iowa	4,119	380	381	435	118	268	..	..	199	..	730	390	1,218
Kentucky	25,175	2,567	1,692	8,647	583	2,535	512	648	2,918	2,029	1,323	138	1,583
Missouri	12,386	2,811	491	5,057	92	229	51	140	774	8	477	465	1,791
Ohio	14,304	1,762	1,114	2,733	879	1,514	41	63	1,079	837	1,161	126	2,995
Total	79,251	11,294	5,894	21,988	2,842	6,554	910	1,017	6,688	3,649	5,156	1,617	11,642
Plains:													
Kansas	3,365	..	173	679	..	..	..	..	39	..	128	858	1,488
Nebraska	1,066	..	..	104	..	..	..	..	..	..	118	227	617
North Dakota	653	..	..	35	..	..	..	..	..	..	143	216	259
Oklahoma (West)	880	(3/)	(3/)	185	..	35	70	53	9	..	79	44	405
South Dakota (East)	683	..	..	10	..	..	..	..	..	..	202	319	152
Texas (West)	360	7	(3/)	108	..	7	90	29	7	..	14	18	80
Total	7,007	7	173	1,121	..	42	160	82	55	..	684	1,682	3,001
Total North	207,072	20,552	23,554	30,716	34,164	23,342	1,953	1,756	9,032	6,791	14,282	7,914	33,016
South:													
South Atlantic:													
North Carolina	21,693	2,473	1,353	4,807	45	1,038	2,805	4,190	1,295	2,062	662	6	957
South Carolina	13,423	460	196	2,518	..	788	2,612	3,661	634	1,302	522	70	660
Virginia	20,598	2,731	1,027	6,630	121	1,129	1,510	1,023	1,606	2,311	504	12	1,994
Total	55,714	5,664	2,576	13,955	166	2,955	6,927	8,874	3,535	5,675	1,688	88	3,611
Southeast:													
Alabama	16,282	1,419	662	4,146	59	548	2,317	2,308	1,935	1,057	420	64	1,347
Florida	4,968	110	14	1,092	..	237	641	1,606	176	41	259	..	792
Georgia	13,808	838	499	3,493	7	529	2,107	2,919	864	1,220	325	25	982
Mississippi	14,651	988	514	4,332	9	471	2,691	1,091	1,541	432	291	392	1,899
Tennessee	12,760	1,770	864	4,204	153	514	543	449	1,595	1,095	453	77	1,043
Total	62,469	5,125	2,553	17,267	228	2,299	8,299	8,373	6,111	3,845	1,748	558	6,063
West Gulf:													
Arkansas	20,540	2,144	1,244	7,696	33	227	2,647	1,288	1,957	5	484	358	2,457
Louisiana	23,228	904	431	5,590	14	801	4,048	3,250	2,103	54	1,296	435	4,302
Oklahoma (East)	3,350	382	198	1,598	..	33	100	135	536	..	67	10	291
Texas (East)	8,834	661	467	3,112	25	144	1,776	887	622	..	334	13	793
Total	55,952	4,091	2,340	17,996	72	1,205	8,571	5,560	5,218	59	2,181	816	7,843
Total South	174,135	14,880	7,469	49,218	466	6,459	23,797	22,807	14,864	9,579	5,617	1,462	17,517
Total Eastern United States	381,207	35,432	31,023	79,934	34,630	29,801	25,750	24,563	23,896	16,370	19,899	9,376	50,533

See footnotes at end of table.

Table 7.--Net volume of live sawtimber on commercial forest land in the United States and Coastal Alaska by species group, and by section, region, and State, January 1, 1953[1] --Continued

(Comparable to Table 10, Basic Forest Statistics for the United States January 1945, revised September 1950)

WESTERN SPECIES

Section, region, and State	Total all species	Softwoods: Total	Douglas-fir	Ponderosa and Jeffrey pine	True firs	Western hemlock	Sugar pine and western white pine	Redwood	Spruce	Lodgepole pine	Other	Hardwoods: Total	Cottonwood and aspen	Red alder	Other
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
West:															
Pacific Northwest:															
Douglas-fir subregion	594,375	577,116	337,251	5,900	58,428	112,065	10,662	90	9,533	334	42,853	17,259	..	9,245	8,014
Pine subregion	154,501	154,317	28,661	86,332	15,080	2,670	1,846	..	2,961	3,219	13,548	184	123	..	61
Total	748,876	731,433	365,912	92,232	73,508	114,735	12,508	90	12,494	3,553	56,401	17,443	123	9,245	8,075
Oregon	433,809	424,721	256,238	72,295	31,316	27,023	9,239	90	3,585	2,303	22,632	9,088	39	3,941	5,108
Washington	315,067	306,712	109,674	19,937	42,192	87,712	3,269	..	8,909	1,250	33,769	8,355	84	5,304	2,967
Total	748,876	731,433	365,912	92,232	73,508	114,735	12,508	90	12,494	3,553	56,401	17,443	123	9,245	8,075
California	360,001	354,024	116,912	66,741	88,717	478	29,515	36,124	170	3,807	11,560	5,977	37	166	5,774
Northern Rocky Mountain:															
Idaho	96,015	95,809	26,586	17,386	15,530	2,113	13,381	..	7,695	3,824	9,294	206	8	..	198
Montana	55,770	55,075	15,329	10,969	1,002	171	1,093	..	6,913	6,945	12,653	695	16	..	679
South Dakota (West)	3,167	3,167	..	3,118	..	..	..	..	49	..	..	..	..	..	..
Wyoming	12,070	11,631	1,305	1,588	451	..	..	..	3,080	5,122	85	439	439	..	..
Total	167,022	165,682	43,220	33,061	16,983	2,284	14,474	..	17,737	15,891	22,032	1,340	463	..	877
Southern Rocky Mountain:															
Arizona	19,988	19,817	1,449	17,534	454	..	..	..	181	..	199	171	171	..	..
Colorado	25,394	23,777	1,343	2,963	2,333	..	..	..	12,474	4,610	54	1,617	1,563	..	54
Nevada	572	565	..	331	177	..	7	..	3	33	14	7	4	3	..
New Mexico	15,054	14,038	1,646	9,672	1,160	..	..	..	1,413	..	147	1,016	1,016	..	..
Utah	7,800	7,392	1,386	1,675	373	..	..	..	1,783	2,157	18	408	365	..	43
Total	68,808	65,589	5,824	32,175	4,497	..	7	..	15,854	6,800	432	3,219	3,119	3	97
Total Western United States	1,344,707	1,316,728	531,868	224,209	183,705	117,497	56,504	36,214	46,255	30,051	90,425	27,979	3,742	9,414	14,823
Coastal Alaska	89,058	88,951	..	..	..	54,398	..	..	26,768	75	7,710	107	..	..	107
Western United States and Coastal Alaska	1,433,765	1,405,679	531,868	[6] 224,209	183,705	171,895	56,504	36,214	73,023	30,126	98,135	28,086	3,742	9,414	14,930

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net volume in board feet log scale, International 1/4-inch rule.
2/ Ponderosa pine. The total volume of ponderosa and Jeffrey pine in the United States is 224,503 million board feet including 294 million board feet in the Plains Region.

3/ Less than 0.5 million board feet.
4/ *Quercus alba* and *Q. prinus*.
5/ *Quercus borealis*, *Q. falcata* var. *pagodaefolia*, and *Q. shumardii*.
6/ Excludes 294 million board feet of ponderosa pine in the Plains Region.

Table 8.--Net volume of growing stock on commercial forest land in the United States and Coastal Alaska, by class of material and softwoods and hardwoods, and by section, region, and State, January 1, 1953[1]/

(Comparable to Table 4, Basic Forest Statistics for the United States January 1945, revised September 1950)

Section, region, and State	Growing stock: Total		Growing stock: Softwood	Growing stock: Hardwood	Sawtimber trees: Total	Sawtimber trees: Softwood	Sawtimber trees: Hardwood	Poletimber trees: Total	Poletimber trees: Softwood	Poletimber trees: Hardwood
	Million cu. ft.	Percent	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
North:										
New England:										
Connecticut	1,304	0.25	158	1,146	533	85	448	771	73	698
Maine	12,601	2.44	5,850	6,751	6,397	3,989	2,408	6,204	1,861	4,343
Massachusetts	1,871	.36	631	1,240	786	373	413	1,085	258	827
New Hampshire	4,452	.86	2,065	2,387	2,366	1,359	1,007	2,086	706	1,380
Rhode Island	161	.03	15	146	52	10	42	109	5	104
Vermont	3,956	.77	1,238	2,718	2,175	827	1,348	1,781	411	1,370
Total	24,345	4.71	9,957	14,388	12,309	6,643	5,666	12,036	3,314	8,722
Middle Atlantic:										
Delaware	464	.09	217	247	284	148	136	180	69	111
Maryland	2,899	.56	806	2,093	1,748	469	1,279	1,151	337	814
New Jersey	952	.18	197	755	440	100	340	512	97	415
New York	11,675	2.26	2,544	9,131	6,708	1,796	4,912	4,967	748	4,219
Pennsylvania	10,629	2.06	1,020	9,609	4,443	704	3,739	6,186	316	5,870
West Virginia	7,864	1.52	606	7,258	4,724	413	4,311	3,140	193	2,947
Total	34,483	6.67	5,390	29,093	18,347	3,630	14,717	16,136	1,760	14,376
Lake States:										
Michigan	9,912	1.92	2,278	7,634	4,540	1,191	3,349	5,372	1,087	4,285
Minnesota	7,235	1.40	2,829	4,406	2,746	1,134	1,612	4,489	1,695	2,794
Wisconsin	8,071	1.56	1,436	6,635	3,436	822	2,614	4,635	614	4,021
Total	25,218	4.88	6,543	18,675	10,722	3,147	7,575	14,496	3,396	11,100
Central:										
Illinois	3,050	.59	14	3,036	2,123	12	2,111	927	2	925
Indiana	3,041	.59	26	3,015	2,084	13	2,071	957	13	944
Iowa	1,183	.23	1	1,182	831	..	831	352	1	351
Kentucky	7,834	1.52	571	7,263	4,853	388	4,465	2,981	183	2,798
Missouri	5,503	1.06	334	5,169	2,810	187	2,623	2,693	147	2,546
Ohio	4,013	.77	96	3,917	2,653	66	2,587	1,360	30	1,330
Total	24,624	4.76	1,042	23,582	15,354	666	14,688	9,270	376	8,894
Plains:										
Kansas	954	.19	8	946	649	3	646	305	5	300
Nebraska	462	.09	65	397	253	36	217	209	29	180
North Dakota	251	.05	1	250	138	..	138	113	1	112
Oklahoma (West)	337	.06	(2/)	337	212	..	212	125	..	125
South Dakota (East)	601	.12	55	546	152	20	132	449	35	414
Texas (West)	223	.04	85	138	154	67	87	69	18	51
Total	2,828	.55	214	2,614	1,558	126	1,432	1,270	88	1,182
Total, North	111,498	21.57	23,146	88,352	58,290	14,212	44,078	53,208	8,934	44,274
South:										
South Atlantic:										
North Carolina	13,642	2.64	6,379	7,263	9,038	4,607	4,431	4,604	1,772	2,832
South Carolina	9,613	1.86	5,288	4,325	6,220	3,593	2,627	3,393	1,695	1,698
Virginia	10,503	2.03	3,210	7,293	6,219	2,058	4,161	4,284	1,152	3,132
Total	33,758	6.53	14,877	18,881	21,477	10,258	11,219	12,281	4,619	7,662
Southeast:										
Alabama	11,713	2.27	5,616	6,097	7,688	3,993	3,695	4,025	1,623	2,402
Florida	8,152	1.58	5,942	2,210	4,525	3,502	1,023	3,627	2,440	1,187
Georgia	12,692	2.46	7,773	4,919	8,174	5,213	2,961	4,518	2,560	1,958
Mississippi	9,628	1.86	3,288	6,340	5,489	2,266	3,223	4,139	1,022	3,117
Tennessee	5,770	1.11	882	4,888	3,289	507	2,782	2,481	375	2,106
Total	47,955	9.28	23,501	24,454	29,165	15,481	13,684	18,790	8,020	10,770
West Gulf:										
Arkansas	11,762	2.28	4,318	7,444	7,880	3,297	4,583	3,882	1,021	2,861
Louisiana	11,199	2.17	3,927	7,272	8,496	3,252	5,244	2,703	675	2,028
Oklahoma (East)	1,780	.34	580	1,200	1,166	412	754	614	168	446
Texas (East)	7,247	1.40	3,864	3,383	5,167	3,035	2,132	2,080	829	1,251
Total	31,988	6.19	12,689	19,299	22,709	9,996	12,713	9,279	2,693	6,586
Total, South	113,701	22.00	51,067	62,634	73,351	35,735	37,616	40,350	15,332	25,018

Table 8.--Net volume of growing stock on commercial forest land in the United States and Coastal Alaska, by class of material and softwoods and hardwoods, and by section, region, and State, January 1, 1953[1] - Continued

(Comparable to Table 4, Basic Forest Statistics for the United States January 1945, revised September 1950)

Section, region, and State	Growing stock				Sawtimber trees			Poletimber trees		
	Total		Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Million cu. ft.	Percent	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
West:										
Pacific Northwest:										
Douglas-fir subregion	113,171	21.89	107,601	5,570	101,055	97,514	3,541	12,116	10,087	2,029
Pine subregion	33,023	6.39	32,980	43	27,729	27,695	34	5,294	5,285	9
Total	146,194	28.28	140,581	5,613	128,784	125,209	3,575	17,410	15,372	2,038
Oregon	80,973	15.66	78,298	2,675	72,455	70,665	1,790	8,518	7,633	885
Washington	65,221	12.62	62,283	2,938	56,329	54,544	1,785	8,892	7,739	1,153
Total	146,194	28.28	140,581	5,613	128,784	125,209	3,575	17,410	15,372	2,038
California	66,711	12.90	63,664	3,047	61,756	60,244	1,512	4,955	3,420	1,535
Northern Rocky Mountain:										
Idaho	21,246	4.11	21,139	107	15,691	15,618	73	5,555	5,521	34
Montana	16,143	3.12	15,895	248	9,002	8,861	141	7,141	7,034	107
South Dakota (West)	1,287	.25	1,287	..	634	634	..	653	653	..
Wyoming	4,087	.79	3,969	118	2,269	2,160	109	1,818	1,809	9
Total	42,763	8.27	42,290	473	27,596	27,273	323	15,167	15,017	150
Southern Rocky Mountain:										
Arizona	3,700	.72	3,624	76	3,254	3,206	48	446	418	28
Colorado	8,037	1.55	7,470	567	4,707	4,410	297	3,330	3,060	270
Nevada	151	.03	126	25	110	109	1	41	17	24
New Mexico	3,683	.71	3,136	547	2,864	2,581	283	819	555	264
Utah	2,001	.39	1,578	423	1,421	1,334	87	580	244	336
Total	17,572	3.40	15,934	1,638	12,356	11,640	716	5,216	4,294	922
Total, West	273,240	52.85	262,469	10,771	230,492	224,366	6,126	42,748	38,103	4,645
Continental United States	498,439	96.42	336,682	161,757	362,133	274,313	87,820	136,306	62,369	73,937
Coastal Alaska	18,496	3.58	18,473	23	17,094	17,073	21	1,402	1,400	2
All regions	516,935	100.0	355,155	161,780	379,227	291,386	87,841	137,708	63,769	73,939

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net volume excluding bark.

2/ Less than 0.5 million cubic feet.

Table 9.--Net volume of growing stock on commercial forest land in Eastern United States by class of material, and by section, region, and State, January 1, 1953[1/]

Section, region, and State	Growing stock: Total		Growing stock: Softwood	Growing stock: Hardwood	Sawtimber trees: Total	Sawtimber trees: Softwood	Sawtimber trees: Hardwood	Poletimber trees: Total	Poletimber trees: Softwood	Poletimber trees: Hardwood
	Million cords	Percent	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords
North:										
New England:										
Connecticut	16.0	0.52	2.0	14.0	7.0	1.0	6.0	9.0	1.0	8.0
Maine	157.0	5.12	73.0	84.0	80.0	50.0	30.0	77.0	23.0	54.0
Massachusetts	23.0	.75	6.0	15.0	10.0	5.0	5.0	13.0	3.0	10.0
New Hampshire	56.0	1.83	26.0	30.0	30.0	17.0	13.0	26.0	9.0	17.0
Rhode Island	2.0	.06	(2/)	2.0	1.0	(2/)	1.0	1.0	(2/)	1.0
Vermont	49.0	1.60	15.0	34.0	27.0	10.0	17.0	22.0	5.0	17.0
Total	303.0	9.88	124.0	179.0	155.0	83.0	72.0	148.0	41.0	107.0
Middle Atlantic:										
Delaware	6.0	.20	3.0	3.0	4.0	2.0	2.0	2.0	1.0	1.0
Maryland	36.0	1.17	10.0	26.0	22.0	6.0	16.0	14.0	4.0	10.0
New Jersey	12.0	.39	3.0	9.0	5.0	1.0	4.0	7.0	2.0	5.0
New York	146.0	4.76	32.0	114.0	84.0	23.0	61.0	62.0	9.0	53.0
Pennsylvania	133.0	4.34	13.0	120.0	56.0	9.0	47.0	77.0	4.0	73.0
West Virginia	98.0	3.20	7.0	91.0	59.0	5.0	54.0	39.0	2.0	37.0
Total	431.0	14.06	68.0	363.0	230.0	46.0	184.0	201.0	22.0	179.0
Lake States:										
Michigan	123.9	4.04	28.5	95.4	56.8	14.9	41.9	67.1	13.6	53.5
Minnesota	90.4	2.95	35.3	55.1	34.3	14.1	20.2	56.1	21.2	34.9
Wisconsin	100.9	3.29	18.0	82.9	43.0	10.3	32.7	57.9	7.7	50.2
Total	315.2	10.28	81.8	233.4	134.1	39.3	94.8	181.1	42.5	138.6
Central:										
Illinois	47.1	1.54	.2	46.9	32.1	.2	31.9	15.0	(3/)	15.0
Indiana	47.0	1.53	.4	46.6	31.6	.2	31.4	15.4	.2	15.2
Iowa	18.3	.60	(3/)	18.3	12.6	..	12.6	5.7	(3/)	5.7
Kentucky	121.6	3.97	8.9	112.7	73.3	5.7	67.6	48.3	3.2	45.1
Missouri	86.1	2.81	5.3	80.8	42.5	2.8	39.7	43.6	2.5	41.1
Ohio	62.1	2.02	1.5	60.6	40.2	1.0	39.2	21.9	.5	21.4
Total	382.2	12.47	16.3	365.9	232.3	9.9	222.4	149.9	6.4	143.5
Plains:										
Kansas	14.8	.48	.1	14.7	9.8	(3/)	9.8	5.0	.1	4.9
Nebraska	7.2	.23	1.0	6.2	3.8	.5	3.3	3.4	.5	2.9
North Dakota	3.1	.10	(3/)	3.1	1.7	..	1.7	1.4	(3/)	1.4
Oklahoma (West)	5.1	.17	(3/)	5.1	3.2	..	3.2	1.9	..	1.9
South Dakota (East)	6.0	.20	(3/)	6.0	1.0	(3/)	1.0	5.0	(3/)	5.0
Texas (West)	3.2	.10	1.1	2.1	2.2	.9	1.3	1.0	.2	.8
Total	39.4	1.28	2.2	37.2	21.7	1.4	20.3	17.7	.8	16.9
Total North	1,470.8	47.97	292.3	1,178.5	773.1	179.6	593.5	697.7	112.7	585.0
South:										
South Atlantic:										
North Carolina	185.0	6.04	86.4	98.6	114.9	58.9	56.0	70.1	27.5	42.6
South Carolina	131.0	4.27	72.3	58.7	79.2	46.0	33.2	51.8	26.3	25.5
Virginia	144.4	4.71	44.5	99.9	79.2	26.6	52.6	65.2	17.9	47.3
Total	460.4	15.02	203.2	257.2	273.3	131.5	141.8	187.1	71.7	115.4
Southeast:										
Alabama	165.9	5.41	74.9	91.0	108.4	53.3	55.1	57.5	21.6	35.9
Florida	113.9	3.72	82.7	31.2	58.3	45.3	13.0	55.6	37.4	18.2
Georgia	174.5	5.69	107.4	67.1	105.1	67.6	37.5	69.4	39.8	29.6
Mississippi	138.4	4.52	43.8	94.6	78.3	30.2	48.1	60.1	13.6	46.5
Tennessee	84.7	2.76	11.7	73.0	48.3	6.7	41.6	36.4	5.0	31.4
Total	677.4	22.10	320.5	356.9	398.4	203.1	195.3	279.0	117.4	161.6
West Gulf:										
Arkansas	168.7	5.50	57.6	111.1	112.4	44.0	68.4	56.3	13.6	42.7
Louisiana	160.9	5.25	52.4	108.5	121.6	43.4	78.2	39.3	9.0	30.3
Oklahoma (East)	25.6	.83	7.7	17.9	16.7	5.5	11.2	8.9	2.2	6.7
Texas (East)	102.0	3.33	51.5	50.5	72.2	40.4	31.8	29.8	11.1	18.7
Total	457.2	14.91	169.2	288.0	322.9	133.3	189.6	134.3	35.9	98.4
Total South	1,595.0	52.03	692.9	902.1	994.6	467.9	526.7	600.4	225.0	375.4
Total Eastern United States	3,065.8	100.00	985.2	2,080.6	1,767.7	647.5	1,120.2	1,298.1	337.7	960.4

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net volume in standard cords (128 cu. ft.) including bark.

2/ Less than 0.5 million cords.

3/ Less than 0.05 million cords.

C-SUPERVISION
Timber Resource Review

Table 10.--Net volume of growing stock on commercial forest land in the United States and Coastal Alaska by species group, and by section, region and State, January 1, 1953 1/

EASTERN SOFTWOODS

Section, region, and State	Total		White and red pine		Jack pine		Southern yellow pine		Spruce and balsam fir		Hemlock		Cypress		Other	
	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords
North:																
New England:																
Connecticut	158	2.0	41	1.0	..	..	..	..	..	..	94	1.0	..	..	23	(2/)
Maine	5,850	73.0	1,011	13.0	..	..	..	..	4,118	51.0	304	4.0	..	..	417	5.0
Massachusetts	631	8.0	344	4.0	..	..	41	1.0	26	(2/)	205	3.0	..	..	15	(2/)
New Hampshire	2,065	26.0	950	12.0	..	..	..	..	704	9.0	355	4.0	..	..	56	1.0
Rhode Island	15	(2/)	12	(2/)	..	..	3	(2/)	..	..	..	..	..	..	..	..
Vermont	1,238	15.0	162	2.0	..	..	..	..	655	8.0	340	4.0	..	..	81	1.0
Total	9,957	124.0	2,520	32.0	..	..	44	1.0	5,503	68.0	1,298	16.0	..	..	592	7.0
Middle Atlantic:																
Delaware	217	3.0	..	..	..	..	201	3.0	..	..	..	..	..	..	16	(2/)
Maryland	806	10.0	..	..	..	..	772	10.0	..	..	..	..	..	..	34	(2/)
New Jersey	197	3.0	..	..	..	..	156	2.0	..	..	..	..	..	..	41	1.0
New York	2,544	32.0	772	10.0	..	..	..	..	710	9.0	901	11.0	..	..	161	2.0
Pennsylvania	1,020	13.0	347	4.0	..	..	..	..	..	..	476	6.0	..	..	197	3.0
West Virginia	606	7.0	75	1.0	..	..	303	3.0	108	1.0	110	2.0	..	..	10	(2/)
Total	5,390	68.0	1,194	15.0	..	..	1,432	18.0	818	10.0	1,487	19.0	..	..	459	6.0
Lake States:																
Michigan	2,278	28.5	411	5.1	271	3.4	..	..	710	8.9	410	5.2	..	..	476	5.9
Minnesota	2,829	35.3	454	5.7	771	9.6	..	..	1,172	14.6	..	..	..	..	432	5.4
Wisconsin	1,436	18.0	469	5.9	257	3.2	..	..	238	3.0	246	3.1	..	..	226	2.8
Total	6,543	81.8	1,334	16.7	1,299	16.2	..	..	2,120	26.5	656	8.3	..	..	1,134	14.1
Central:																
Illinois	14	.2	..	..	..	..	..	..	..	..	..	..	5	0.1	9	.1
Indiana	26	.4	..	..	..	..	18	.3	..	..	..	..	1	(3/)	7	.1
Iowa	1	(3/)	..	..	..	..	..	..	..	..	..	..	..	..	1	(3/)
Kentucky	571	8.9	10	.2	..	..	430	6.7	..	..	62	.9	10	.1	59	1.0
Missouri	334	5.3	..	..	..	..	229	3.7	..	..	..	..	48	.7	57	.9
Ohio	96	1.5	..	..	..	..	71	1.1	..	..	..	..	..	..	25	.4
Total	1,042	16.3	10	.2	..	..	748	11.8	..	..	62	.9	64	.9	158	2.5
Plains:																
Kansas	4/ 8	.1	..	..	..	..	..	..	..	..	..	..	..	..	4/ 8	.1
Nebraska	65	1.0	..	..	..	..	..	..	..	..	..	..	..	..	65	1.0
North Dakota	1	(3/)	..	..	..	..	..	..	..	..	..	..	..	..	1	(3/)
Oklahoma (West)	6/(5/)	(3/)	..	..	..	..	..	..	..	..	..	..	(5/)	(3/)	6/(5/)	(3/)
South Dakota (East)	55	(3/)	..	..	..	..	..	..	..	..	..	..	..	..	55	(3/)
Texas (West)	85	1.1	..	..	..	..	85	1.1	..	..	..	..	(5/)	(3/)	(3/)	(3/)
Total	214	2.2	..	..	..	..	85	1.1	..	..	..	..	(5/)	(3/)	129	1.1
Total North	23,146	292.3	5,058	63.9	1,299	16.2	2,309	31.9	8,441	104.5	3,503	44.2	64	.9	2,472	30.7
South:																
South Atlantic:																
North Carolina	6,379	86.4	51	.6	..	..	5,843	80.1	14	.2	129	1.4	268	3.1	74	1.0
South Carolina	5,288	72.3	6	.1	..	..	4,898	66.6	..	..	6	.1	351	5.1	27	.4
Virginia	3,210	44.5	121	1.5	..	..	2,901	40.8	..	..	89	1.0	77	.9	22	.3
Total	14,877	203.2	178	2.2	..	..	13,642	187.5	14	.2	224	2.5	696	9.1	123	1.7
Southeast:																
Alabama	5,616	74.9	..	..	..	..	5,496	73.3	..	..	(5/)	(3/)	82	1.1	38	.5
Florida	5,942	82.7	..	..	..	..	4,679	64.7	..	..	..	..	1,240	17.7	23	.3
Georgia	7,773	107.4	31	.4	..	..	7,254	101.1	..	..	9	.1	472	5.7	7	.1
Mississippi	3,288	43.8	..	..	..	..	3,130	41.7	..	..	..	..	150	2.0	8	.1
Tennessee	882	11.7	52	.7	..	..	665	8.8	..	..	45	.6	38	.5	82	1.1
Total	23,501	320.5	83	1.1	..	..	21,224	289.6	..	..	54	.7	1,982	27.0	158	2.1
West Gulf:																
Arkansas	4,318	57.6	..	..	..	..	4,138	55.2	..	..	..	..	165	2.2	15	.2
Louisiana	3,927	52.4	..	..	..	..	3,402	45.4	..	..	..	..	525	7.0	(5/)	(3/)
Oklahoma (East)	580	7.7	..	..	..	..	580	7.7	..	..	..	..	(5/)	(3/)	(5/)	(3/)
Texas (East)	3,864	51.5	..	..	..	..	3,789	50.5	..	..	..	..	75	1.0	(5/)	(3/)
Total	12,689	169.2	..	..	..	..	11,909	158.8	..	..	..	..	765	10.2	15	.2
Total South	51,067	692.9	261	3.3	..	..	46,775	635.9	14	.2	278	3.2	3,443	46.3	296	4.0
Eastern United States	74,213	985.2	5,319	67.2	1,299	16.2	49,084	667.8	8,455	104.7	3,781	47.4	3,507	47.2	2,768	34.7

See footnotes at end of table.

C-SUPERVISION
Timber Resource Review

Table 10.--Net volume of growing stock on commercial forest land in the United States and Coastal Alaska by species group, and by section, region and State, January 1, 1953[1] --Continued

EASTERN HARDWOODS

Section, region, and State	Total		Oak		Beech, yellow birch, and hard maple		Hickory		Sweetgum		Tupelo and blackgum		Yellow-poplar		Cottonwood and aspen		Other	
	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords
North:																		
New England:																		
Connecticut	1,146	14.0	596	7.0	72	2.0	64	1.0	..	..	..	..	23	(2/)	..	..	391	4.0
Maine	6,751	84.0	83	1.0	3,093	39.0	..	..	..	..	..	..	..	..	178	2.0	3,397	42.0
Massachusetts	1,240	15.0	491	6.0	252	3.0	..	..	..	..	..	..	..	..	24	(2/)	473	6.0
New Hampshire	2,387	30.0	227	3.0	1,144	14.0	..	..	..	..	..	..	..	..	47	1.0	969	12.0
Rhode Island	146	2.0	80	1.0	4	(2/)	6	(2/)	..	..	..	..	..	..	..	..	56	1.0
Vermont	2,718	34.0	87	1.0	1,727	21.0	..	..	..	..	..	..	..	..	96	1.0	808	11.0
Total	14,388	179.0	1,564	19.0	6,292	79.0	70	1.0	..	..	..	..	23	(2/)	345	4.0	6,094	76.0
Middle Atlantic:																		
Delaware	247	3.0	147	2.0	..	..	13	(2/)	54	1.0	..	..	..	..	11	(2/)	22	(2/)
Maryland	2,093	26.0	950	12.0	65	1.0	99	1.0	235	3.0	67	1.0	279	3.0	..	..	398	5.0
New Jersey	755	9.0	401	5.0	71	1.0	37	(2/)	48	1.0	10	(2/)	36	(2/)	10	(2/)	142	2.0
New York	9,131	114.0	1,240	16.0	3,952	49.0	142	2.0	..	..	..	..	..	..	381	5.0	3,416	42.0
Pennsylvania	9,609	120.0	4,776	60.0	1,551	19.0	258	3.0	..	..	..	..	371	5.0	..	..	2,653	33.0
West Virginia	7,258	91.0	3,094	39.0	1,323	16.0	578	7.0	..	..	123	2.0	562	7.0	..	..	1,578	20.0
Total	29,093	363.0	10,608	134.0	6,962	86.0	1,127	13.0	337	5.0	200	3.0	1,248	15.0	402	5.0	8,209	102.0
Lake States:																		
Michigan	7,634	95.4	1,134	14.2	2,091	26.1	56	.7	..	..	..	..	..	..	1,768	22.1	2,585	32.3
Minnesota	4,406	55.1	771	9.6	139	1.7	8	.1	..	..	..	..	..	..	1,862	23.3	1,626	20.4
Wisconsin	6,635	82.9	1,870	23.4	920	11.5	24	.3	..	..	..	..	..	..	1,742	21.7	2,079	26.0
Total	18,675	233.4	3,775	47.2	3,150	39.3	88	1.1	..	..	..	..	..	..	5,372	67.1	6,290	78.7
Central:																		
Illinois	3,036	46.9	1,520	23.3	83	1.3	267	4.2	39	.6	9	.1	36	.6	66	1.0	1,016	15.8
Indiana	3,015	46.6	1,115	17.1	379	5.9	285	4.5	55	.9	34	.5	141	2.2	35	.5	971	15.0
Iowa	1,182	18.3	339	5.2	30	.5	88	1.4	..	..	..	..	..	..	85	1.3	640	9.9
Kentucky	7,263	112.7	3,566	55.2	628	9.7	962	15.0	158	2.5	177	2.7	495	7.6	27	.4	1,250	19.6
Missouri	5,169	80.8	3,575	55.9	46	.7	424	6.7	18	.3	38	.6	4	.1	126	1.9	938	14.6
Ohio	3,917	60.6	1,413	21.7	398	6.1	377	5.9	11	.2	17	.3	208	3.2	24	.4	1,469	22.8
Total	23,582	365.9	11,528	178.4	1,564	24.2	2,403	37.7	281	4.5	275	4.2	884	13.7	363	5.5	6,284	97.7
Plains:																		
Kansas	946	14.7	284	4.4	..	..	23	.4	..	..	..	..	..	..	148	2.2	491	7.7
Nebraska	397	6.2	94	1.5	..	..	3	(3/)	..	..	..	..	..	..	99	1.6	201	3.1
North Dakota	250	3.1	20	.2	..	..	..	..	..	..	..	..	..	..	120	1.5	110	1.4
Oklahoma (West)	337	5.1	73	1.1	..	..	(5/)	(3/)	26	.4	20	.3	..	..	13	.2	205	3.1
South Dakota (East)	546	6.0	..	..	..	..	..	..	..	..	..	..	..	..	180	2.0	366	4.0
Texas (West)	138	2.1	40	.6	..	..	(5/)	(3/)	33	.5	13	.2	..	..	7	.1	45	.7
Total	2,614	37.2	511	7.8	..	..	26	.4	59	.9	33	.5	..	..	567	7.6	1,418	20.0
Total North	88,352	1,178.5	27,986	386.4	17,968	228.5	3,714	53.2	677	10.4	508	7.7	2,155	28.7	7,049	89.2	28,295	374.4
South:																		
South Atlantic:																		
North Carolina	7,263	98.6	2,897	39.3	102	1.4	416	5.6	913	12.4	1,204	16.0	756	10.4	1	(3/)	974	13.5
South Carolina	4,325	58.7	1,012	12.7	27	.4	217	2.7	797	11.2	1,145	16.2	321	4.5	31	.5	775	10.5
Virginia	7,293	99.9	3,563	48.6	185	2.5	644	8.9	604	9.3	383	4.3	704	9.5	6	.1	1,204	16.7
Total	18,881	257.2	7,472	100.6	314	4.3	1,277	17.2	2,314	32.9	2,732	36.5	1,781	24.4	38	.6	2,953	40.7
Southeast:																		
Alabama	6,097	91.0	2,278	34.0	121	1.8	777	11.6	884	13.2	838	12.5	308	4.6	20	.3	871	13.0
Florida	2,210	31.2	430	6.3	16	.2	63	1.0	263	3.6	728	10.1	30	.4	1	(3/)	679	9.6
Georgia	4,919	67.1	1,605	21.7	24	.3	291	3.9	769	10.5	1,142	15.7	378	5.1	6	.1	704	9.8
Mississippi	6,340	94.6	2,488	37.1	100	1.5	583	8.7	1,340	20.0	523	7.8	161	2.4	107	1.6	1,038	15.5
Tennessee	4,888	73.0	2,522	37.7	168	2.5	704	10.5	208	3.1	161	2.4	375	5.6	20	.3	730	10.9
Total	24,454	356.9	9,323	136.8	429	6.3	2,418	35.7	3,464	50.4	3,392	48.5	1,252	18.1	154	2.3	4,022	58.8
West Gulf:																		
Arkansas	7,444	111.1	4,012	59.9	34	.5	804	12.0	972	14.5	389	5.8	(5/)	(3/)	94	1.4	1,139	17.0
Louisiana	7,272	108.5	2,073	30.9	154	2.3	603	9.0	1,273	19.0	1,092	16.3	13	.2	114	1.7	1,950	29.1
Oklahoma (East)	1,200	17.9	784	11.7	(5/)	(3/)	194	2.9	34	.5	47	.7	..	..	..	..	141	2.1
Texas (East)	3,383	50.5	1,621	24.2	47	.7	234	3.5	670	10.0	288	4.3	(5/)	(3/)	7	.1	516	7.7
Total	19,299	288.0	8,490	126.7	235	3.5	1,835	27.4	2,949	44.0	1,816	27.1	13	.2	215	3.2	3,746	55.9
Total South	62,634	902.1	25,285	364.1	978	14.1	5,530	80.3	8,727	127.3	7,940	112.1	3,046	42.7	407	6.1	10,721	155.4
Eastern United States	150,986	2,080.6	53,271	750.5	18,946	242.6	9,244	133.5	9,404	137.7	8,448	119.8	5,201	71.4	7,456	95.3	39,016	529.8

See footnotes at end of table.

Table 10.--Net volume of growing stock on commercial forest land in the United States and Coastal Alaska by species group, and by section, region and State, January 1, 1953[1] --Continued

WESTERN SPECIES

Section, region, and State	Total all species	Softwood: Total	Douglas-fir	Ponderosa and Jeffrey pine	True firs	Western hemlock and Sitka spruce	Redwood	Engelmann and other spruces	Lodgepole pine	Larch	Other	Hardwood: Total	Cottonwood and aspen	Red alder	Other
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
West:															
Pacific Northwest:															
Douglas-fir subregion	113,171	107,601	59,064	856	11,949	25,360	13	76	195	38	10,050	5,570	..	3,426	2,144
Pine subregion	33,023	32,980	5,411	16,130	4,329	508	..	607	2,648	1,618	1,729	43	41	..	2
Total	146,194	140,581	64,475	16,986	16,278	25,868	13	683	2,843	1,656	11,779	5,613	41	3,426	2,146
Oregon	80,973	78,298	42,877	13,071	6,936	7,492	13	106	2,045	410	5,348	2,675	17	1,272	1,386
Washington	65,221	62,283	21,598	3,915	9,342	18,376	..	577	798	1,246	6,431	2,938	24	2,154	760
Total	146,194	140,581	64,475	16,986	16,278	25,868	13	683	2,843	1,656	11,779	5,613	41	3,426	2,146
California	66,711	63,664	20,758	11,935	16,099	113	6,360	..	1,092	..	7,307	3,047	36	57	2,954
Northern Rocky Mountain:															
Idaho	21,246	21,139	5,563	3,096	3,301	506	..	1,399	2,803	1,309	3,162	107	102	..	5
Montana	16,143	15,895	4,684	2,231	422	56	..	1,384	4,077	2,390	651	248	242	..	6
South Dakota (West)	1,287	1,287	..	1,260	..	..	..	27	..	..	..	..	..	..	..
Wyoming	4,087	3,969	450	720	90	..	..	630	2,079	..	..	118	118	..	..
Total	42,763	42,290	10,697	7,307	3,813	562	..	3,440	8,959	3,699	3,813	473	462	..	11
Southern Rocky Mountain:															
Arizona	3,700	3,624	335	3,100	110	..	..	45	..	..	34	76	76	..	..
Colorado	8,037	7,470	450	990	990	..	..	3,150	1,890	..	..	567	540	..	27
Nevada	151	126	..	126	..	..	..	..	..	..	..	25	25	..	..
New Mexico	3,683	3,136	480	1,924	323	..	..	378	..	..	31	547	547	..	..
Utah	2,001	1,578	278	278	93	..	..	371	558	..	..	423	423	..	..
Total	17,572	15,934	1,543	6,418	1,516	..	..	3,944	2,448	..	65	1,638	1,611	..	27
Total West	273,240	262,469	97,473	7/ 42,646	37,706	26,543	6,373	8,067	15,342	5,355	8/ 22,964	10,771	2,150	3,483	5,138
Coastal Alaska	18,496	18,473	..	..	..	16,724	..	34	17	..	1,698	23	(5/)	(5/)	23
Western United States and Coastal Alaska	291,736	280,942	97,473	7/ 42,646	37,706	43,267	6,373	8,101	15,359	5,355	8/ 24,662	10,794	2,150	3,483	5,161

1/ Prepared by Forest Service U. S. Department of Agriculture. Net volume in cubic feet excluding bark and in standard cords (128 cu. ft.) including bark.
2/ Less than 0.5 million cords.
3/ Less than 0.05 million cords.
4/ Includes 64 million cubic feet of ponderosa pine.
5/ Less than 0.5 million cubic feet.
6/ Ponderosa pine. The total volume of ponderosa and Jeffrey pine in the United States is 42,765 million cubic feet, including 119 million cubic feet of ponderosa pine in the Plains Region.
7/ Excludes 119 million cubic feet of ponderosa pine in the Plains Region.
8/ Includes about 9.5 billion cubic feet of sugar pine and western white pine.

Table 11.--Net volume of growing stock and live sawtimber on commercial forest land in the United States and Coastal Alaska, by ownership class, and by section, region, and State, January 1, 1953[1/]

(Comparable to Table 6, Basic Forest Statistics for the United States January 1945, revised September 1950)

Section, region, and State	Growing stock: All ownerships	Growing stock: Federal ownership or trusteeship: Total	Growing stock: Federal: National forest	Growing stock: Federal: Indian[2/]	Growing stock: Federal: Bureau of land management[2/]	Growing stock: Federal: Other[2/]	Growing stock: State, county and municipal[2/]	Growing stock: Private	Live sawtimber: All ownerships	Live sawtimber: Federal ownership or trusteeship: Total	Live sawtimber: Federal: National forest	Live sawtimber: Federal: Indian[2/]	Live sawtimber: Federal: Bureau of land management[2/]	Live sawtimber: Federal: Other[2/]	Live sawtimber: State county and municipal[2/]	Live sawtimber: Private
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
North:																
New England:																
Connecticut	1,304	1	..	..	..	1	136	1,167	1,859	1	..	..	..	1	158	1,700
Maine	12,601	84	49	..	..	35	132	12,385	28,226	189	110	..	..	79	297	27,740
Massachusetts	1,871	11	..	..	..	11	231	1,629	2,659	14	..	..	..	14	235	2,410
New Hampshire	4,452	752	751	..	..	1	76	3,624	10,069	1,672	1,661	..	..	11	120	8,277
Rhode Island	161	..	..	..	..	..	12	149	165	(3/)	..	..	..	(3/)	20	145
Vermont	3,956	245	238	..	..	7	91	3,620	8,547	556	539	..	..	17	179	7,812
Total	24,345	1,093	1,038	..	..	55	678	22,574	51,525	2,432	2,310	..	..	122	1,009	48,084
Middle Atlantic:																
Delaware	464	1	..	..	..	1	12	451	1,234	2	..	..	..	2	34	1,198
Maryland	2,899	52	..	..	..	52	168	2,679	6,771	108	8	..	..	100	399	6,264
New Jersey	952	1	..	..	..	1	90	861	1,660	1	..	..	..	1	156	1,503
New York	11,675	70	..	..	..	70	981	10,624	26,883	107	..	..	..	107	2,043	24,733
Pennsylvania	10,629	265	245	..	..	20	1,451	8,913	19,306	481	445	..	..	36	2,635	16,190
West Virginia	7,864	669	658	..	..	11	55	7,140	18,497	1,258	1,238	..	..	20	130	17,109
Total	34,483	1,058	903	..	..	155	2,757	30,668	74,351	1,957	1,691	..	..	266	5,397	66,997
Lake States:																
Michigan	9,912	1,183	1,119	8	3	53	1,560	7,169	21,141	2,226	2,100	13	6	107	2,400	16,515
Minnesota	7,235	1,769	1,367	348	16	38	2,283	3,183	12,538	3,012	2,433	489	24	66	3,078	6,448
Wisconsin	8,071	1,316	713	500	3	100	1,082	5,673	16,111	2,952	1,119	1,643	5	185	1,551	11,608
Total	25,218	4,268	3,199	856	22	191	4,925	16,025	49,790	8,190	5,652	2,145	35	358	7,029	34,571
Central:																
Illinois	3,050	147	122	..	..	25	8	2,895	11,694	564	468	..	..	96	30	11,100
Indiana	3,041	96	50	..	..	46	80	2,865	11,671	330	153	..	..	177	222	11,119
Iowa	1,183	10	1	(4/)	..	9	13	1,160	4,119	34	1	2	..	31	49	4,036
Kentucky	7,834	527	380	..	..	147	39	7,268	27,342	1,931	1,420	..	..	511	156	25,255
Missouri	5,503	548	504	..	(4/)	44	59	4,896	13,195	1,319	1,212	..	1	106	141	11,735
Ohio	4,013	57	57	..	..	(4/)	133	3,823	14,650	187	187	..	..	..	445	14,018
Total	24,624	1,385	1,114	(4/)	(4/)	271	332	22,907	82,671	4,365	3,441	2	1	921	1,043	77,263
Plains:																
Kansas	954	(4/)	..	..	..	(4/)	..	954	3,371	2	..	..	..	2	..	3,369
Nebraska	462	50	48	2	..	..	14	398	1,253	16	10	6	..	..	12	1,225
North Dakota	251	91	..	56	..	35	3	157	653	238	..	146	1	91	4	411
Oklahoma (West)	337	..	..	..	..	..	5	332	880	..	..	..	..	..	15	865
South Dakota (East)	601	259	24	229	4	2	18	324	790	167	3	164	..	..	11	612
Texas (West)	223	..	..	..	..	..	..	223	730	..	..	..	..	..	..	730
Total	2,828	400	72	287	4	37	40	2,388	7,677	423	13	316	1	93	42	7,212
Total North	111,498	8,204	6,326	1,143	26	709	8,732	94,562	266,014	17,367	13,107	2,463	37	1,760	14,520	234,127
South:																
South Atlantic:																
North Carolina	13,642	876	708	25	..	143	128	12,638	44,152	3,123	2,566	80	..	477	473	40,556
South Carolina	9,613	628	472	..	..	156	95	8,890	32,299	1,930	1,400	..	..	530	278	30,091
Virginia	10,503	927	781	..	..	146	95	9,481	30,407	2,752	2,292	..	..	460	344	27,311
Total	33,758	2,431	1,961	25	..	445	318	31,009	106,858	7,805	6,258	80	..	1,467	1,095	97,958
Southeast:																
Alabama	11,713	492	404	..	5	83	84	11,137	38,211	1,793	1,512	..	14	267	250	36,168
Florida	8,152	810	525	6	5	274	137	7,205	23,032	2,121	1,344	12	14	751	383	20,528
Georgia	12,692	1,045	464	..	..	581	88	11,559	36,920	3,965	1,577	..	..	2,388	275	32,680
Mississippi	9,628	800	661	7	2	130	365	8,463	25,789	3,036	2,607	21	8	400	963	21,790
Tennessee	5,770	519	350	..	..	169	167	5,084	15,350	1,665	1,170	..	..	495	426	13,259
Total	47,955	3,666	2,404	13	12	1,237	841	43,448	139,302	12,580	8,210	33	36	4,301	2,297	124,425

Table 11.--Net volume of growing stock and live sawtimber on commercial forest land in the United States and Coastal Alaska, by ownership class, and by section, region, and State, January 1, 1953[1]--Continued

(Comparable to Table 6, Basic Forest Statistics for the United States January 1945, revised September 1950)

Section, region, and State	Growing stock								Live sawtimber							
	All ownerships	Federal ownership or trusteeship: Total	National forest	Indian[2]	Bureau of land management[2]	Other[2]	State, county and municipal[2]	Private	All ownerships	Federal ownership or trusteeship: Total	National forest	Indian[2]	Bureau of land management[2]	Other[2]	State, county and municipal[2]	Private
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
South:--Continued:																
West Gulf:																
Arkansas	11,762	1,602	1,340	..	67	195	59	10,101	38,317	5,513	4,655	..	220	638	194	32,610
Louisiana	11,199	327	266	..	2	59	138	10,734	41,436	1,096	871	..	7	218	515	39,825
Oklahoma (East)	1,780	119	95	5	(4/)	19	22	1,639	5,580	468	380	20	(3/)	68	77	5,035
Texas (East)	7,247	712	678	2	..	32	6	6,529	25,575	2,925	2,842	4	..	79	24	22,626
Total	31,988	2,760	2,379	7	69	305	225	29,003	110,908	10,002	8,748	24	227	1,003	810	100,096
Total South	113,701	8,857	6,744	45	81	1,987	1,384	103,460	357,068	30,387	23,216	137	263	6,771	4,202	322,479
West:																
Pacific Northwest:																
D.-fir subregion	113,171	53,753	41,524	1,357	10,700	172	6,851	52,567	594,375	288,403	221,658	6,759	59,106	880	35,100	270,872
Pine subregion	33,023	23,142	18,170	4,409	532	31	1,068	8,813	154,501	110,679	87,249	20,978	2,359	93	4,661	39,161
Total	146,194	76,895	59,694	5,766	11,232	203	7,919	61,380	748,876	399,082	308,907	27,737	61,465	973	39,761	310,033
Oregon	80,973	49,871	36,825	2,170	10,876	..	2,512	28,590	433,809	266,780	196,278	10,617	59,885	..	13,582	153,447
Washington	65,221	27,024	22,869	3,596	356	203	5,407	32,790	315,067	132,302	112,629	17,120	1,580	973	26,179	156,586
Total	146,194	76,895	59,694	5,766	11,232	203	7,919	61,380	748,876	399,082	308,907	27,737	61,465	973	39,761	310,033
California	66,711	33,911	32,086	656	1,092	77	861	31,939	360,001	189,069	178,913	3,969	5,817	370	4,742	166,190
Northern Rocky Mtn:																
Idaho	21,246	14,813	14,284	80	449	..	1,763	4,670	96,015	65,505	63,220	310	1,975	..	8,818	21,692
Montana	16,143	10,863	9,941	515	398	9	709	4,571	55,770	36,350	32,954	2,213	1,162	21	2,787	16,633
South Dakota (West)	1,287	1,011	1,003	..	7	1	66	210	3,167	2,657	2,638	..	19	..	181	329
Wyoming	4,087	3,561	3,150	161	250	..	186	340	12,070	10,833	9,420	628	757	28	169	1,068
Total	42,763	30,248	28,378	756	1,104	10	2,724	9,791	167,022	115,345	108,232	3,151	3,913	49	11,955	39,722
Southern Rocky Mtn:																
Arizona	3,700	3,534	2,727	805	2	..	26	140	19,988	19,151	14,276	4,864	11	..	116	721
Colorado	8,037	6,903	6,570	33	295	5	134	1,000	25,394	23,013	22,032	192	782	7	302	2,079
Nevada	151	38	38	..	(4/)	..	..	113	572	89	87	..	2	..	..	483
New Mexico	3,683	2,491	1,990	421	50	30	100	1,092	15,054	11,201	8,620	2,254	226	101	350	3,503
Utah	2,001	1,780	1,407	44	329	..	32	189	7,800	7,056	5,461	139	1,456	..	104	640
Total	17,572	14,746	12,732	1,303	676	35	292	2,534	68,808	60,510	50,476	7,449	2,477	108	872	7,426
Total West	273,240	155,800	132,890	8,481	14,104	325	11,796	105,644	1,344,707	764,006	646,528	42,306	73,672	1,500	57,330	523,371
Continental U. S.	498,439	172,861	145,960	9,669	14,211	3,021	21,912	303,666	1,967,789	811,760	682,851	44,906	73,972	10,031	76,052	1,079,977
Coastal Alaska	18,496	18,429	17,139	13	1,277	..	..	67	89,058	88,736	82,524	61	6,151	..	..	322
All Regions	516,935	191,290	163,099	9,682	15,488	3,021	21,912	303,733	2,056,847	900,496	765,375	44,967	80,123	10,031	76,052	1,080,299

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net volume of live sawtimber in board feet log scale, International 1/4-inch rule, and of growing stock in cubic feet excluding bark.

2/ Because of different definitions of commercial forest land, different cruising standards, specifications, and log rules adopted by the Forest Service and other public agencies, volume estimates for these ownerships may vary from actual published figures of the public agencies concerned.

3/ Less than 0.5 million board feet.

4/ Less than 0.5 million cubic feet.

Table 12.--Net annual growth of growing stock and live sawtimber on commercial forest land in the United States and Coastal Alaska, by softwoods and hardwoods, and by section, region, and State, 1952[1]

(Comparable to Table 7, Basic Forest Statistics for the United States, January 1945, revised September 1950)

Section, region, and State	Growing stock						Live sawtimber		
	Total		Softwood		Hardwood		Total	Softwood	Hardwood
	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million bd. ft.	Million bd. ft.	Million bd. ft.
North:									
New England:									
Connecticut	68	1.0	10	(2/)	58	1.0	106	18	88
Maine	375	6.0	141	3.0	234	3.0	821	463	358
Massachusetts	80	(2/)	25	(2/)	55	(2/)	139	68	71
New Hampshire	212	3.0	80	1.0	132	2.0	472	259	213
Rhode Island	9	(2/)	1	(2/)	8	(2/)	9	2	7
Vermont	134	1.0	34	(2/)	100	1.0	310	104	206
Total	878	11.0	291	4.0	587	7.0	1,857	914	943
Middle Atlantic:									
Delaware	18	(2/)	7	(2/)	11	(2/)	56	19	37
Maryland	117	2.0	24	1.0	93	1.0	324	59	265
New Jersey	38	(2/)	6	(2/)	32	(2/)	81	13	68
New York	393	5.0	66	1.0	327	4.0	1,041	214	827
Pennsylvania	357	4.0	26	(2/)	331	4.0	750	93	657
West Virginia	434	6.0	27	(2/)	407	6.0	908	72	836
Total	1,357	17.0	156	2.0	1,201	15.0	3,160	470	2,690
Lake States:									
Michigan	433	5.4	135	1.7	298	3.7	1,010	287	723
Minnesota	385	4.8	118	1.5	267	3.3	788	328	460
Wisconsin	362	4.5	66	.8	296	3.7	895	187	708
Total	1,180	14.7	319	4.0	861	10.7	2,693	802	1,891
Central:									
Illinois	135	2.1	1	(3/)	134	2.1	496	2	494
Indiana	139	2.2	1	(3/)	138	2.2	497	2	495
Iowa	49	.8	(4/)	(3/)	49	.8	219	..	219
Kentucky	365	5.6	28	.4	337	5.2	1,410	188	1,222
Missouri	270	4.2	12	.2	258	4.0	785	44	741
Ohio	170	2.7	4	.1	166	2.6	556	13	543
Total	1,128	17.6	46	.7	1,082	16.9	3,963	249	3,714
Plains:									
Kansas	39	.6	(4/)	(3/)	39	.6	178	(5/)	178
Nebraska	19	.3	3	(3/)	16	.3	66	10	56
North Dakota	9	.1	..	..	9	.1	28	..	28
Oklahoma (West)	16	.2	(4/)	(3/)	16	.2	43	(5/)	43
South Dakota (East)	21	.3	1	(3/)	20	.3	44	6	38
Texas (West)	12	.2	5	.1	7	.1	42	24	18
Total	116	1.7	9	.1	107	1.6	401	40	361
Total, North	4,659	62.0	821	10.8	3,838	51.2	12,074	2,475	9,599
South:									
South Atlantic:									
North Carolina	802	11.8	416	6.0	386	5.8	2,951	1,606	1,345
South Carolina	509	7.0	334	4.6	175	2.4	1,851	1,195	656
Virginia	597	8.9	219	3.3	378	5.6	2,078	869	1,209
Total	1,908	27.7	969	13.9	939	13.8	6,880	3,670	3,210
Southeast:									
Alabama	769	10.8	431	5.7	338	5.1	2,770	1,864	906
Florida	458	6.4	362	5.1	96	1.3	1,625	1,389	236
Georgia	869	12.6	590	8.6	279	4.0	3,174	2,370	804
Mississippi	716	10.2	279	3.7	437	6.5	1,628	887	741
Tennessee	244	3.6	52	.7	192	2.9	838	169	669
Total	3,056	43.6	1,714	23.8	1,342	19.8	10,035	6,679	3,356
West Gulf:									
Arkansas	573	8.2	268	3.6	305	4.6	2,253	1,220	1,033
Louisiana	687	9.8	292	3.9	395	5.9	2,691	1,445	1,246
Oklahoma (East)	97	1.4	36	.5	61	.9	286	145	141
Texas (East)	486	6.8	285	3.8	201	3.0	1,872	1,336	536
Total	1,843	26.2	881	11.8	962	14.4	7,102	4,146	2,956
Total, South	6,807	97.5	3,564	49.5	3,243	48.0	24,017	14,495	9,522

Table 12.--Net annual growth of growing stock and live sawtimber on commercial forest land in the United States and Coastal Alaska, by softwoods and hardwoods, and by section, region, and State, 1952[1] - Continued

(Comparable to Table 7, Basic Forest Statistics for the United States, January 1945, revised September 1950)

Section, region, and State	Growing stock						Live sawtimber		
	Total		Softwood		Hardwood		Total	Softwood	Hardwood
	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million cu. ft.	Million cords	Million bd. ft.	Million bd. ft.	Million bd. ft.
West:									
Pacific Northwest:									
Douglas-fir subregion	998	..	943	..	55	..	5,149	5,010	139
Pine subregion	329	..	329	..	..	..	828	824	4
Total	1,327	..	1,272	..	55	..	5,977	5,834	143
Oregon	686	..	658	..	28	..	3,560	3,481	79
Washington	641	..	614	..	27	..	2,417	2,353	64
Total	1,327	..	1,272	..	55	..	5,977	5,834	143
California	595	..	539	..	56	..	2,939	2,895	44
Northern Rocky Mountain:									
Idaho	354	..	352	..	2	..	1,139	1,135	4
Montana	172	..	164	..	8	..	247	229	18
South Dakota (West)	26	..	26	..	..	..	61	61	..
Wyoming	51	..	49	..	2	..	87	83	4
Total	603	..	591	..	12	..	1,534	1,508	26
Southern Rocky Mountain:									
Arizona	27	..	27	..	..	..	134	132	2
Colorado	110	..	96	..	14	..	241	224	17
Nevada	2	..	2	..	(4/)	..	5	5	..
New Mexico	72	..	62	..	10	..	311	281	30
Utah	9	..	7	..	2	..	37	35	2
Total	220	..	194	..	26	..	728	677	51
Total, West	2,745	..	2,596	..	149	..	11,178	10,914	264
Continental United States	14,211	..	6,981	..	7,230	..	47,269	27,884	19,385
Coastal Alaska	32	..	32	..	(4/)	..	128	127	1
All regions	14,243	..	7,013	..	7,230	..	47,397	28,011	19,386

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net growth of live sawtimber in board feet log scale, International 1/4-inch rule, and of growing stock in cubic feet excluding bark and in standard cords (128 cu. ft.) including bark. Equivalent net annual growth in cords has not been shown for the West and Coastal Alaska.

2/ Less than 0.5 million cords.
3/ Less than 0.05 million cords.
4/ Less than 0.5 million cubic feet.
5/ Less than 0.5 million board feet.

Table 13.--Timber products output in the United States and Coastal Alaska, by selected products and softwoods and hardwoods, and by section, region, and State of origin, 1952 [1]

Section, region, and State	Sawlogs (for lumber, etc.)			Pulpwood			Veneer logs and bolts			All other products		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Number cords	Number cords	Number cords	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
North:												
New England:												
Connecticut	23,373	7,979	15,394	6,034	2,954	3,080	..	..	..	9,578	726	8,852
Maine	606,485	504,606	101,879	1,916,388	1,578,344	338,044	37,787	..	37,787	50,815	29,974	20,841
Massachusetts	113,036	83,745	29,291	18,615	11,095	7,520	..	..	..	12,069	2,465	9,604
New Hampshire	332,670	293,742	38,928	249,784	169,612	80,172	14,055	..	14,055	23,523	11,154	12,369
Rhode Island	2,505	157	2,348	5,000	2,745	2,255	..	..	..	1,091	107	984
Vermont	269,728	170,258	99,470	211,721	178,651	33,070	14,611	2	14,609	23,629	6,924	16,705
Total	1,347,797	1,060,487	287,310	2,407,542	1,943,401	464,141	66,453	2	66,451	120,705	51,350	69,355
Middle Atlantic:												
Delaware	38,322	30,769	7,553	35,581	35,581	..	3,648	66	3,582	4,032	2,033	1,999
Maryland	229,393	126,137	103,256	91,700	74,542	17,158	9,873	66	9,807	30,366	9,198	21,168
New Jersey	23,899	4,497	19,402	86,992	56,551	30,441	2,033	656	1,377	9,114	2,554	6,560
New York	483,926	198,284	285,642	411,262	347,494	63,768	19,118	..	19,118	74,549	14,885	59,664
Pennsylvania	428,874	106,307	322,567	366,836	78,908	287,928	4,715	..	4,715	91,581	5,018	86,563
West Virginia	456,729	30,558	426,171	87,846	12,093	75,753	2,446	..	2,446	51,588	95	51,493
Total	1,661,143	496,552	1,164,591	1,080,217	605,169	475,048	41,833	788	41,045	261,230	33,783	227,447
Lake States:												
Michigan	482,660	108,650	374,010	744,628	455,627	289,001	36,208	160	36,048	144,825	27,159	117,666
Minnesota	191,250	98,800	92,450	921,282	662,367	258,915	7,256	7	7,249	95,796	27,944	67,852
Wisconsin	332,100	82,950	249,150	565,283	277,350	287,933	26,980	172	26,808	145,33[illegible]	17,708	127,624
Total	1,006,010	290,400	715,610	2,231,193	1,395,344	835,849	70,444	339	70,105	385,953	72,811	313,142
Central:												
Illinois	110,000	660	109,340	45,000	..	45,000	9,280	..	9,280	32,056	..	32,056
Indiana	190,300	381	189,919	12,000	..	12,000	10,125	..	10,125	32,335	92	32,243
Iowa	55,000	1,155	53,845	1,000	..	1,000	4,219	..	4,219	18,703	..	18,703
Kentucky	522,500	52,250	470,250	30,000	2,100	27,900	10,907	327	10,580	129,255	3,321	125,934
Missouri	200,300	30,245	170,055	12,000	3,480	8,520	8,437	..	8,437	90,324	1,842	88,482
Ohio	249,075	2,717	246,358	35,000	..	35,000	10,125	..	10,125	32,932	1	32,931
Total	1,327,175	87,408	1,239,767	135,000	5,580	129,420	53,093	327	52,766	335,605	5,256	330,349
Plains:												
Kansas	17,600	35	17,565	..	..	..	2,531	..	2,531	9,710	..	9,710
Nebraska	4,400	748	3,652	..	..	..	1,687	..	1,687	4,080	135	3,945
North Dakota	2,350	..	2,350	..	..	..	..	..	..	4,585	104	4,481
Oklahoma (West)	6,000	..	6,000	..	..	..	261	..	261	23,415	875	22,540
South Dakota (East)	989	..	989	..	..	..	..	..	..	1,491	727	764
Texas (West)	25,000	10,000	15,000	7,706	7,706	..	782	..	782	72,952	5,652	67,300
Total	56,339	10,783	45,556	7,706	7,706	..	5,261	..	5,261	116,233	7,493	108,740
Total North	5,398,464	1,945,63[illegible]	3,452,834	5,861,658	3,957,200	1,904,458	237,084	1,456	235,628	1,219,726	170,693	1,049,033
South:												
South Atlantic:												
North Carolina	2,068,598	1,450,294	618,304	1,366,131	1,119,088	247,043	98,746	9,419	89,327	334,028	178,317	155,711
South Carolina	1,084,001	805,196	278,805	1,309,326	1,151,245	158,081	104,643	3,081	101,562	156,235	92,730	63,505
Virginia	1,313,228	749,853	563,375	1,078,167	855,776	222,391	35,301	1,562	33,739	215,545	99,775	115,770
Total	4,465,827	3,005,343	1,460,484	3,753,624	3,126,109	627,515	238,690	14,062	224,628	705,808	370,822	334,986
Southeast:												
Alabama	1,710,000	1,169,000	541,000	1,608,681	1,583,704	24,977	60,864	348	60,516	196,061	93,132	102,929
Florida	558,533	525,954	32,579	1,598,210	1,584,952	13,258	67,917	8,366	59,551	66,834	50,265	16,569
Georgia	2,420,533	1,923,113	497,420	2,534,753	2,413,959	120,794	111,479	1,597	109,882	240,894	149,580	91,314
Mississippi	1,271,000	719,000	552,000	1,867,266	1,385,005	482,261	81,558	8,173	73,385	268,070	69,302	198,768
Tennessee	557,000	173,840	383,160	268,438	114,514	153,924	9,569	206	9,363	193,526	28,180	165,346
Total	6,517,066	4,510,907	2,006,159	7,877,348	7,082,134	795,214	331,387	18,690	312,697	965,385	390,459	574,926

Table 13.--Timber products output in the United States and Coastal Alaska, by selected products and softwoods and hardwoods, and by section, region, and State of origin, 1952[1] --Continued

Section, region, and State	Sawlogs (for lumber, etc.)			Pulpwood			Veneer logs and bolts			All other products		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Number cords	Number cords	Number cords	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
South: --Continued												
West Gulf:												
Arkansas	985,000	575,000	410,000	620,156	533,938	86,218	44,865	..	44,865	199,625	57,781	141,844
Louisiana	955,000	511,000	444,000	1,237,264	1,103,976	133,288	45,126	1,826	43,300	197,192	70,922	126,270
Oklahoma (East)	62,000	43,000	19,000	34,870	34,870	..	348	..	348	38,350	8,095	30,255
Texas (East)	1,153,000	965,000	188,000	1,152,212	1,091,690	60,522	60,690	3,043	57,647	130,774	80,835	49,939
Total	3,155,000	2,094,000	1,061,000	3,044,502	2,764,474	280,028	151,029	4,869	146,160	565,941	217,633	348,308
Total South	14,137,893	9,610,250	4,527,643	14,675,474	12,972,717	1,702,757	721,106	37,621	683,485	2,237,134	978,914	1,258,220
West:												
Pacific Northwest:												
Douglas-fir subregion	10,524,368	10,503,169	21,199	3,875,504	3,827,568	47,936	1,216,791	1,216,791	..	636,411	635,616	795
Pine subregion	1,951,628	1,951,628	..	71,537	71,302	235	12,963	12,963	..	127,964	127,964	..
Total	12,475,996	12,454,797	21,199	3,947,041	3,898,870	48,171	1,229,754	1,229,754	..	764,375	763,580	795
Oregon	8,945,000	8,937,192	7,808	1,357,230	1,348,399	8,831	948,875	948,875	..	449,592	449,062	530
Washington	3,530,996	3,517,605	13,391	2,589,811	2,550,471	39,340	280,879	280,879	..	314,783	314,518	265
Total	12,475,996	12,454,797	21,199	3,947,041	3,898,870	48,171	1,229,754	1,229,754	..	764,375	763,580	795
California	4,903,011	4,902,411	600	269,295	269,243	52	270,842	270,842	..	146,446	141,750	4,696
Northern Rocky Mountain:												
Idaho	1,155,998	1,155,813	185	155,575	153,887	1,688	8,525	8,525	..	46,043	45,835	208
Montana	691,001	691,001	..	139,775	139,775	..	..	..	..	23,642	22,410	1,232
South Dakota (West)	39,997	39,997	..	404	404	..	..	..	..	3,378	3,212	166
Wyoming	77,999	77,999	..	1,209	1,209	..	..	..	..	3,603	3,447	156
Total	1,964,995	1,964,810	185	296,963	295,275	1,688	8,525	8,525	..	76,666	74,904	1,762
Southern Rocky Mountain:												
Arizona	239,997	239,997	..	..	..	..	..	..	..	27,647	20,726	6,921
Colorado	169,000	168,860	140	14,502	14,502	..	..	..	..	15,497	14,422	1,075
Nevada	1,005	1,005	..	..	..	..	..	..	..	296	296	..
New Mexico	110,993	110,993	..	..	..	..	..	..	..	23,416	17,656	5,760
Utah	35,003	34,478	525	..	..	..	..	..	..	3,365	2,875	490
Total	555,998	555,333	665	14,502	14,502	..	..	..	..	70,221	55,975	14,246
Total West	19,900,000	19,877,351	22,649	4,527,801	4,477,890	49,911	1,509,121	1,509,121	..	1,057,708	1,036,209	21,499
Continental United States	39,436,357	31,433,231	8,003,126	25,064,933	21,407,807	3,657,126	2,467,311	1,548,198	919,113	4,514,568	2,185,816	2,328,752
Coastal Alaska	73,820	73,820	..	2,846	2,846	..	25	25	..	2,996	2,861	135
All Regions	39,510,177	31,507,051	8,003,126	25,067,779	21,410,653	3,657,126	2,467,336	1,548,223	919,113	4,517,564	2,188,677	2,328,887

1/ Prepared by Forest Service, U. S. Department of Agriculture. Estimates of timber products output include both roundwood and plant residues. The output from roundwood is according to States and regions where the logs, bolts, and other round timbers, cut for various products, originated and not necessarily where they were processed into lumber, pulp, veneer or other manufactured products or used in round form as poles, piling, posts, etc. The volume of plant residues such as used for fuelwood or chipped for pulp is, however, according to States and regions where used. The output of fuelwood, although second to sawlogs on a cubic-volume basis, is included with the "all other products" group because estimates are likely to be considerably in error for individual States. Other products including cooperage logs and bolts, poles and piling, posts, hewn ties, mine timbers and various miscellaneous products like box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, etc., are grouped because their combined output represents only a comparatively small fraction of total timber products output. Volumes are in units of measure commonly used by the Bureau of the Census, the trade, or other agencies reporting volume of output, i.e., sawlogs for lumber, timbers, sawn ties etc., in board feet lumber tally, pulpwood in standard cords (128 cu. ft.) including bark, and veneer logs and bolts in board feet log scale. Volumes for other products are shown in cubic feet excluding bark.

Table 14.--Timber cut from live sawtimber on commercial forest land in the United States and Coastal Alaska, by selected products and softwoods and hardwoods, and by section, region, and State of origin, 1952[1]

Section, region, and State	All products: Total	All products: Softwood	All products: Hardwood	Sawlogs (for lumber etc.): Total	Sawlogs: Softwood	Sawlogs: Hardwood	Pulpwood: Total	Pulpwood: Softwood	Pulpwood: Hardwood	Veneer logs and bolts: Total	Veneer: Softwood	Veneer: Hardwood	All other products: Total	All other: Softwood	All other: Hardwood
	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.
North:															
New England:															
Connecticut	18,902	6,191	12,711	18,383	6,137	12,246	35	..	35	..	..	..	484	54	430
Maine	1,032,312	860,081	172,231	490,285	411,534	78,751	493,679	443,982	49,697	39,226	..	39,226	9,122	4,565	4,557
Massachusetts	86,157	61,760	24,397	81,812	59,256	22,556	3,487	2,106	1,381	..	..	..	858	398	460
New Hampshire	343,338	274,093	69,245	253,926	223,787	30,139	60,636	42,118	18,518	14,940	..	14,940	13,836	8,188	5,648
Rhode Island	2,210	131	2,079	1,963	118	1,845	141	..	141	..	..	..	106	13	93
Vermont	285,537	178,662	106,875	212,202	134,905	77,297	49,208	42,944	6,264	15,388	..	15,388	8,739	813	7,926
Total	1,768,456	1,380,918	387,538	1,058,571	835,737	222,834	607,186	531,150	76,036	69,554	..	69,554	33,145	14,031	19,114
Middle Atlantic:															
Delaware	40,374	28,379	11,995	24,995	18,855	6,140	5,382	5,382	..	3,736	80	3,656	6,261	4,062	2,199
Maryland	249,063	119,316	129,747	182,717	94,474	88,243	13,717	11,276	2,441	10,124	81	10,043	42,505	13,485	29,020
New Jersey	33,743	11,098	22,645	16,927	2,242	14,685	9,729	7,692	2,037	2,167	712	1,455	4,920	452	4,468
New York	630,415	224,936	405,479	474,200	168,300	305,900	68,848	54,765	14,083	20,652	..	20,652	66,715	1,871	64,844
Pennsylvania	427,769	99,941	327,828	343,908	86,947	256,961	48,606	12,994	35,612	5,072	..	5,072	30,183	..	30,183
West Virginia	413,552	23,861	389,691	354,056	22,495	331,561	13,677	1,347	12,330	2,531	..	2,531	43,288	19	43,269
Total	1,794,916	507,531	1,287,385	1,396,803	393,313	1,003,490	159,959	93,456	66,503	44,282	873	43,409	193,872	19,889	173,983
Lake States:															
Michigan	594,391	155,837	438,554	419,110	93,222	325,888	56,511	46,113	10,398	41,861	190	41,671	76,909	16,312	60,597
Minnesota	242,392	124,488	117,904	150,248	84,771	65,477	35,149	25,833	9,316	8,375	8	8,367	48,620	13,876	34,744
Wisconsin	403,624	103,634	299,990	272,951	71,174	201,777	36,180	25,738	10,442	31,179	205	30,974	63,314	6,517	56,797
Total	1,240,407	383,959	856,448	842,309	249,167	593,142	127,840	97,684	30,156	81,415	403	81,012	188,843	36,705	152,138
Central:															
Illinois	172,959	594	172,365	130,069	594	129,475	637	..	637	13,205	..	13,205	29,048	..	29,048
Indiana	268,801	346	268,455	207,614	346	207,268	47	..	47	14,405	..	14,405	46,735	..	46,735
Iowa	76,219	1,071	75,148	55,460	1,071	54,389	..	..	..	5,555	..	5,555	15,204	..	15,204
Kentucky	694,812	48,958	645,854	517,280	46,550	470,730	778	128	650	14,102	390	13,712	162,652	1,890	160,762
Missouri	315,504	31,988	283,516	184,434	26,636	157,798	2,035	..	2,035	10,395	..	10,395	118,640	5,352	113,288
Ohio	280,675	2,499	278,176	228,901	2,499	226,402	1,307	..	1,307	12,572	..	12,572	37,895	..	37,895
Total	1,808,970	85,456	1,723,514	1,323,758	77,696	1,246,062	4,804	128	4,676	70,234	390	69,844	410,174	7,242	402,932
Plains:															
Kansas	27,742	33	27,709	17,775	33	17,742	..	..	..	3,333	..	3,333	6,634	..	6,634
Nebraska	10,206	1,448	8,758	4,383	694	3,689	..	..	..	2,222	..	2,222	3,601	754	2,847
North Dakota	4,703	67	4,636	2,066	..	2,066	..	..	..	..	..	..	2,637	67	2,570
Oklahoma (West)	10,686	44	10,642	6,087	..	6,087	..	..	..	436	..	436	4,163	44	4,119
S. Dak. (East)	786	..	786	786	..	786	..	..	..	..	..	..	..	..	..
Texas (West)	39,409	10,647	28,762	24,944	9,728	15,216	689	689	..	1,315	..	1,315	12,461	230	12,231
Total	93,532	12,239	81,293	56,041	10,455	45,586	689	689	..	7,306	..	7,306	29,496	1,095	28,401
Total North	6,706,281	2,370,103	4,336,178	4,677,482	1,566,368	3,111,114	900,478	723,107	177,371	272,791	1,666	271,125	855,530	78,962	776,568
South:															
South Atlantic:															
North Carolina	2,381,496	1,541,970	839,526	1,878,136	1,248,703	629,433	213,827	187,007	26,820	133,579	11,380	122,199	155,954	94,880	61,074
South Carolina	1,410,637	952,658	457,979	977,097	693,274	283,823	208,566	191,207	17,359	140,197	3,638	136,559	84,777	64,539	20,238
Virginia	1,560,032	865,305	694,727	1,219,139	645,623	573,516	170,371	142,150	28,221	47,400	1,853	45,547	123,122	75,679	47,443
Total	5,352,165	3,359,933	1,992,232	4,074,372	2,587,600	1,486,772	592,764	520,364	72,400	321,176	16,871	304,305	363,853	235,098	128,755
Southeast:															
Alabama	2,377,047	1,497,633	879,414	1,685,899	1,137,135	548,764	144,742	141,639	3,103	88,559	354	88,205	457,847	218,505	239,342
Florida	930,546	807,643	122,903	486,011	452,846	33,165	265,575	265,456	119	92,250	10,198	82,052	86,710	79,143	7,567
Georgia	2,899,327	2,198,796	700,531	2,162,173	1,655,800	506,373	414,310	401,425	12,885	149,025	1,885	147,140	173,819	139,686	34,133
Mississippi	2,211,431	986,159	1,225,272	1,259,323	699,402	559,921	205,205	123,586	81,619	115,652	8,386	107,266	631,251	154,785	476,466
Tennessee	992,835	233,889	758,946	557,761	169,100	388,661	29,519	10,242	19,277	13,867	215	13,652	391,688	54,332	337,356
Total	9,411,186	5,724,120	3,687,066	6,151,167	4,114,283	2,036,884	1,059,351	942,348	117,003	459,353	21,038	438,315	1,741,315	646,451	1,094,864

Table 14.--Timber cut from live sawtimber on commercial forest land in the United States and Coastal Alaska, by selected products and softwoods and hardwoods, and by section, region, and State of origin, 1952[1] --Continued

Section, region, and State	All products: Total	All products: Softwood	All products: Hardwood	Sawlogs (for lumber etc.): Total	Sawlogs: Softwood	Sawlogs: Hardwood	Pulpwood: Total	Pulpwood: Softwood	Pulpwood: Hardwood	Veneer logs and bolts: Total	Veneer logs: Softwood	Veneer logs: Hardwood	All other products: Total	All other products: Softwood	All other products: Hardwood
	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.
South: --Continued															
West Gulf:															
Arkansas	1,551,784	684,512	867,272	975,211	559,327	415,884	61,243	47,355	13,888	65,383	..	65,383	449,947	77,830	372,117
Louisiana	1,595,472	749,438	846,034	947,443	497,071	450,372	120,758	98,680	22,078	65,045	1,873	63,172	462,226	151,814	310,412
Oklahoma (East)	141,549	52,104	89,445	61,101	41,828	19,273	3,118	3,118	..	505	..	505	76,825	7,158	69,667
Texas (East)	1,546,406	1,150,323	396,083	1,129,394	938,696	190,698	106,918	97,537	9,381	87,251	3,112	84,139	222,843	110,978	111,865
Total	4,835,211	2,636,377	2,198,834	3,113,149	2,036,922	1,076,227	292,037	246,690	45,347	218,184	4,985	213,199	1,211,841	347,780	864,061
Total South	19,598,562	11,720,430	7,878,132	13,338,688	8,738,805	4,599,883	1,944,152	1,709,402	234,750	998,713	42,894	955,819	3,317,009	1,229,329	2,087,680
West:															
Pacific Northwest:															
Douglas-fir subregion	12,220,815	12,169,523	51,292	8,989,826	8,971,166	18,660	1,695,397	1,667,305	28,092	1,176,240	1,176,240	..	359,352	354,812	4,540
Pine subregion	2,049,861	2,049,718	143	1,957,740	1,957,740	..	37,923	37,780	143	14,368	14,368	..	39,830	39,830	..
Total	14,270,676	14,219,241	51,435	10,947,566	10,928,906	18,660	1,733,320	1,705,085	28,235	1,190,608	1,190,608	..	399,182	394,642	4,540
Oregon	9,808,242	9,790,998	17,244	8,171,549	8,163,091	8,458	531,998	526,497	5,501	924,005	924,005	..	180,690	177,405	3,285
Washington	4,462,434	4,428,243	34,191	2,776,017	2,765,815	10,202	1,201,322	1,178,588	22,734	266,603	266,603	..	218,492	217,237	1,255
Total	14,270,676	14,219,241	51,435	10,947,566	10,928,906	18,660	1,733,320	1,705,085	28,235	1,190,608	1,190,608	..	399,182	394,642	4,540
California	5,724,198	5,704,180	20,018	5,281,982	5,266,878	15,104	53,914	53,574	340	332,181	331,659	522	56,121	52,069	4,052
Northern Rocky Mtn:															
Idaho	1,124,566	1,123,570	996	1,054,616	1,054,415	201	33,191	32,397	794	8,797	8,797	..	27,962	27,961	1
Montana	663,734	662,902	832	613,851	613,851	..	25,748	25,748	..	..	..	..	24,135	23,303	832
S. Dakota (West)	40,800	40,574	226	37,516	37,516	..	132	132	..	..	..	..	3,152	2,926	226
Wyoming	69,916	69,777	139	64,871	64,871	..	497	497	..	..	..	..	4,548	4,409	139
Total	1,899,016	1,896,823	2,193	1,770,854	1,770,653	201	59,568	58,774	794	8,797	8,797	..	59,797	58,599	1,198
Southern Rocky Mtn:															
Arizona	254,725	254,142	583	254,142	254,142	..	..	..	..	..	..	..	583	..	583
Colorado	145,307	142,210	3,097	130,745	130,599	146	..	..	..	..	..	..	14,562	11,611	2,951
Nevada	1,077	1,077	..	1,047	1,047	..	..	..	..	..	..	..	30	30	..
New Mexico	114,384	114,384	..	114,384	114,384	..	..	..	..	..	..	..	..	..	..
Utah	39,511	37,180	2,331	36,384	35,834	550	..	..	..	..	..	..	3,127	1,346	1,781
Total	555,004	548,993	6,011	536,702	536,006	696	..	..	..	..	..	..	18,302	12,987	5,315
Total West	22,448,894	22,369,237	79,657	18,537,104	18,502,443	34,661	1,846,802	1,817,433	29,369	1,531,586	1,531,064	522	533,402	518,297	15,105
Continental U. S.	48,753,737	36,459,770	12,293,967	36,553,274	28,807,616	7,745,658	4,691,432	4,249,942	441,490	2,803,090	1,575,624	1,227,466	4,705,941	1,826,588	2,879,353
Coastal Alaska	86,092	86,092	..	82,924	82,924	..	1,833	1,833	..	31	31	..	1,304	1,304	..
All Regions	48,839,829	36,545,862	12,293,967	36,636,198	28,890,540	7,745,658	4,693,265	4,251,775	441,490	2,803,121	1,575,655	1,227,466	4,707,245	1,827,892	2,879,353

1/ Prepared by Forest Service, U. S. Department of Agriculture. Estimates of timber cut include logging residues as well as sawlog material removed as timber products. Timber cut for fuelwood, although third in volume next to pulpwood, is included with the "all other products" group because estimates are likely to be considerably in error for individual States. Other products including cooperage logs and bolts, poles and piling, posts, hewn ties, mine timbers, and various miscellaneous products like box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, etc., are grouped because their combined cut is only a comparatively small fraction of the total for all products. Volumes refer to live sawtimber inventory and are in net board feet log scale, International 1/4-inch rule.

Table 15.--Timber cut from growing stock on commercial forest land in the United States and Coastal Alaska, by selected products and softwoods and hardwoods, and by section, region, and State of origin, 1952[1]

Section, region, and State	All products			Sawlogs (for lumber etc.)			Pulpwood			Veneer logs and bolts			All other products		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
North:															
New England:															
Connecticut	9,010	1,981	7,029	4,297	1,413	2,884	445	222	223	..	..	..	4,268	346	3,922
Maine	284,819	221,687	63,132	115,997	95,081	20,916	151,170	124,337	26,833	7,900	..	7,900	9,752	2,269	7,483
Massachusetts	25,696	15,542	10,154	19,593	14,151	5,442	1,356	829	527	..	..	..	4,747	562	4,185
New Hampshire	98,280	74,517	23,763	65,136	56,917	8,219	19,473	13,600	5,873	2,907	..	2,907	10,764	4,000	6,764
Rhode Island	1,321	294	1,027	440	28	412	367	205	162	..	..	..	514	61	453
Vermont	81,092	47,061	34,031	51,983	31,810	20,173	16,607	14,187	2,420	2,933	..	2,933	9,569	1,064	8,505
Total	500,218	361,082	139,136	257,446	199,400	58,046	189,418	153,380	36,038	13,740	..	13,740	39,614	8,302	31,312
Middle Atlantic:															
Delaware	11,480	8,646	2,834	6,308	4,967	1,341	2,509	2,509	..	732	13	719	1,931	1,157	774
Maryland	64,159	32,744	31,415	41,423	23,696	17,727	6,541	5,258	1,283	1,917	14	1,903	14,278	3,776	10,502
New Jersey	13,356	5,627	7,729	3,974	821	3,153	6,389	4,091	2,298	423	133	290	2,570	582	1,988
New York	140,570	51,301	89,269	91,941	33,133	58,808	22,218	17,225	4,993	3,970	..	3,970	22,441	943	21,498
Pennsylvania	130,886	24,984	105,902	73,807	18,523	55,284	27,601	6,092	21,509	957	..	957	28,521	369	28,152
West Virginia	108,848	6,202	102,646	77,503	5,191	72,312	7,111	981	6,130	530	..	530	23,704	30	23,674
Total	469,299	129,504	339,795	294,956	86,331	208,625	72,369	36,156	36,213	8,529	160	8,369	93,445	6,857	86,588
Lake States:															
Michigan	215,510	67,045	148,465	92,220	20,808	71,412	59,719	35,568	24,151	7,201	34	7,167	56,370	10,635	45,735
Minnesota	148,111	78,511	69,600	37,775	18,920	18,855	73,299	51,665	21,634	1,438	1	1,437	35,599	7,925	27,674
Wisconsin	173,549	43,010	130,539	64,687	15,893	48,794	45,863	21,613	24,250	5,366	38	5,328	57,633	5,466	52,167
Total	537,170	188,566	348,604	194,682	55,621	139,061	178,881	108,846	70,035	14,005	73	13,932	149,602	24,026	125,576
Central:															
Illinois	37,955	92	37,863	19,809	92	19,717	2,567	..	2,567	2,173	..	2,173	13,406	..	13,406
Indiana	52,076	145	51,931	33,285	53	33,232	744	..	744	2,313	..	2,313	15,734	92	15,642
Iowa	16,970	165	16,805	9,396	165	9,231	62	..	62	942	..	942	6,570	..	6,570
Kentucky	161,566	10,134	151,432	83,001	7,320	75,681	1,677	119	1,558	2,189	57	2,132	74,699	2,638	72,061
Missouri	83,504	5,969	77,535	31,916	4,050	27,866	584	202	382	1,806	..	1,806	49,198	1,717	47,481
Ohio	53,071	406	52,665	37,004	404	36,600	2,170	1	2,169	1,972	..	1,972	11,925	1	11,924
Total	405,142	16,911	388,231	214,411	12,084	202,327	7,804	322	7,482	11,395	57	11,338	171,532	4,448	167,084
Plains:															
Kansas	7,773	5	7,768	3,116	5	3,111	..	..	..	584	..	584	4,073	..	4,073
Nebraska	2,936	242	2,694	753	107	646	..	..	..	390	..	390	1,793	135	1,658
North Dakota	3,243	68	3,175	447	..	447	..	..	..	..	..	..	2,796	68	2,728
Oklahoma (West)	2,911	170	2,741	1,314	..	1,314	..	..	..	80	..	80	1,517	170	1,347
South Dakota (East)	154	19	135	135	..	135	..	..	..	..	..	..	19	19	..
Texas (West)	11,087	3,456	7,631	5,147	1,863	3,284	497	497	..	240	..	240	5,203	1,096	4,107
Total	28,104	3,960	24,144	10,912	1,975	8,937	497	497	..	1,294	..	1,294	15,401	1,488	13,913
Total North	1,939,933	700,023	1,239,910	972,407	355,411	616,996	448,969	299,201	149,768	48,963	290	48,673	469,594	45,121	424,473
South:															
South Atlantic:															
North Carolina	646,803	415,470	231,333	398,308	267,289	131,019	88,692	74,578	14,114	28,994	2,629	26,365	130,809	70,974	59,835
South Carolina	380,165	261,598	118,567	207,477	148,398	59,079	85,388	76,253	9,135	30,317	843	29,474	56,983	36,104	20,879
Virginia	427,980	238,788	189,192	257,577	138,198	119,379	71,540	56,689	14,851	10,259	430	9,829	88,604	43,471	45,133
Total	1,454,948	915,856	539,092	863,362	553,885	309,477	245,620	207,520	38,100	69,570	3,902	65,668	276,396	150,549	125,847
Southeast:															
Alabama	581,812	370,657	211,155	336,161	217,732	118,429	103.518	102,114	1,404	16,184	68	16,116	125,949	50,743	75,206
Florida	251,793	224,483	27,310	103,837	96,933	6,904	105,925	105,863	62	20,054	2,354	17,700	21,977	19,333	2,644
Georgia	749,662	573,051	176,611	459,833	354,430	105,403	166,866	160,086	6,780	32,199	437	31,762	90,764	58,098	32,666
Mississippi	569,748	257,544	312,204	254,753	133,917	120,836	126,044	89,099	36,945	21,185	1,594	19,591	167,766	32,934	134,832
Tennessee	252,444	53,418	199,026	116,256	32,379	83,877	16,111	7,385	8,726	2,534	41	2,493	117,543	13,613	103,930
Total	2,405,459	1,479,153	926,306	1,270,840	835,391	435,449	518,464	464,547	53,917	92,156	4,494	87,662	523,999	174,721	349,278

Table 15.--Timber cut from growing stock on commercial forest land in the United States and Coastal Alaska, by selected products and softwoods and hardwoods, and by section, region, and State of origin, 1952 1/ --Continued

Section, region, and State	All products			Sawlogs (for lumber etc.)			Pulpwood			Veneer logs and bolts			All other products		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
South: --Continued															
West Gulf:															
Arkansas	380,386	164,617	215,769	196,849	107,097	89,752	40,428	34,141	6,287	11,946	..	11,946	131,163	23,379	107,784
Louisiana	405,140	198,565	206,575	192,371	95,176	97,195	81,137	71,143	9,994	11,896	356	11,540	119,736	31,890	87,846
Oklahoma (East)	39,077	13,351	25,726	12,168	8,009	4,159	2,248	2,248	..	93	..	93	24,568	3,094	21,474
Texas (East)	368,243	274,568	93,675	220,891	179,736	41,155	74,565	70,319	4,246	15,962	592	15,370	56,825	23,921	32,904
Total	1,192,846	651,101	541,745	622,279	390,018	232,261	198,378	177,851	20,527	39,897	948	38,949	332,292	82,284	250,008
Total South	5,053,253	3,046,110	2,007,143	2,756,481	1,779,294	977,187	962,462	849,918	112,544	201,623	9,344	192,279	1,132,687	407,554	725,133
West:															
Pacific Northwest:															
Douglas-fir subregion	2,031,275	2,022,525	8,750	1,495,973	1,492,797	3,176	281,951	277,236	4,715	188,958	188,958	..	64,393	63,534	859
Pine subregion	359,271	359,249	22	340,995	340,995	..	6,820	6,798	22	2,398	2,398	..	9,058	9,058	..
Total	2,390,546	2,381,774	8,772	1,836,968	1,833,792	3,176	288,771	284,034	4,737	191,356	191,356	..	73,451	72,592	859
Oregon	1,608,676	1,605,871	2,805	1,347,394	1,346,018	1,376	84,182	83,317	865	145,811	145,811	..	31,289	30,725	564
Washington	781,870	775,903	5,967	489,574	487,774	1,800	204,589	200,717	3,872	45,545	45,545	..	42,162	41,867	295
Total	2,390,546	2,381,774	8,772	1,836,968	1,833,792	3,176	288,771	284,034	4,737	191,356	191,356	..	73,451	72,592	859
California	931,536	920,389	11,147	862,611	853,295	9,316	10,199	9,936	263	48,194	47,926	268	10,532	9,232	1,300
Northern Rocky Mountain:															
Idaho	188,268	187,952	316	170,119	170,086	33	5,592	5,463	129	1,508	1,508	..	11,049	10,895	154
Montana	117,688	116,841	847	96,684	96,684	..	11,111	11,111	..	..	..	..	9,893	9,046	847
South Dakota (West)	8,506	8,454	52	7,131	7,131	..	34	34	..	..	..	..	1,341	1,289	52
Wyoming	14,631	14,589	42	12,705	12,705	..	93	93	..	..	..	..	1,833	1,791	42
Total	329,093	327,836	1,257	286,639	286,606	33	16,830	16,701	129	1,508	1,508	..	24,116	23,021	1,095
Southern Rocky Mountain:															
Arizona	41,676	41,416	260	41,313	41,313	..	..	..	..	..	..	..	363	103	260
Colorado	30,970	30,369	601	26,870	26,845	25	..	..	..	..	..	..	4,100	3,524	576
Nevada	221	221	..	186	186	..	..	..	..	..	..	..	35	35	..
New Mexico	18,674	18,674	..	18,593	18,593	..	..	..	..	..	..	..	81	81	..
Utah	8,499	7,907	592	6,498	6,401	97	..	..	..	..	..	..	2,001	1,506	495
Total	100,040	98,587	1,453	93,460	93,338	122	..	..	..	..	..	..	6,580	5,249	1,331
Total West	3,751,215	3,728,586	22,629	3,079,678	3,067,031	12,647	315,800	310,671	5,129	241,058	240,790	268	114,679	110,094	4,585
Continental United States	10,744,401	7,474,719	3,269,682	6,808,566	5,201,736	1,606,830	1,727,231	1,459,790	267,441	491,644	250,424	241,220	1,716,960	562,769	1,154,191
Coastal Alaska	12,372	12,372	..	11,887	11,887	..	267	267	..	4	4	..	214	214	..
All Regions	10,756,773	7,487,091	3,269,682	6,820,453	5,213,623	1,606,830	1,727,498	1,460,057	267,441	491,648	250,428	241,220	1,717,174	562,983	1,154,191

1/ Prepared by Forest Service, U. S. Department of Agriculture. Estimates of timber cut refer to growing stock inventory and include logging residues as well as growing stock material removed as timber products. Timber cut for fuelwood, although third in volume next to pulpwood, is included with the "all other products" group because estimates are likely to be considerably in error for individual States. Other products including cooperage logs and bolts, poles and piling, posts, hewn ties, mine timbers and various miscellaneous products like box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, etc., are grouped because their combined cut is only a comparatively small fraction of the total for all products. Volumes are in net cubic feet roundwood excluding bark.

Table 16.--Commercial and noncommercial forest land requiring protection from fire in the United States and Coastal Alaska, and status of protection by ownership class and by section, region, and State, 1952[1]

Section, region, and State	All ownerships: Total	All ownerships: Total	Protected[2]: Class 1	Protected[2]: Class 2	Protected[2]: Class 3	Unprotected	Federal ownership or trusteeship: Total	Federal: Total	Protected[2]: Class 1	Protected[2]: Class 2	Protected[2]: Class 3	Unprotected
	Thousand acres	Percent	Percent	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Percent	Percent
North:												
New England:												
Connecticut	1,990	100	100	(3/)	..	..	1	100	100	..	..	..
Maine	17,088	100	(3/)	100	..	..	115	100	44	56	..	..
Massachusetts	3,288	100	13	87	..	..	36	100	100	..	..	..
New Hampshire	4,848	100	56	44	..	..	669	100	98	2	..	..
Rhode Island	434	100	8	90	2	..	..	..	..	..	..	..
Vermont	3,730	100	100	..	..	..	213	100	100	..	..	..
Total	31,378	100	28	72	(3/)	..	1,034	100	93	7	..	..
Middle Atlantic:												
Delaware	454	100	57	43	..	..	1	100	100	..	..	..
Maryland	2,920	100	100	..	..	..	70	100	100	..	..	..
New Jersey	1,958	100	51	49	..	..	33	100	..	100	..	..
New York	14,450	100	45	47	8	..	125	100	2	98	..	..
Pennsylvania	15,205	100	100	(3/)	..	..	501	100	100	(3/)	..	..
West Virginia	9,907	100	38	11	51	..	900	100	83	17	..	..
Total	44,894	100	66	20	14	..	1,630	100	81	19	..	..
Lake States:												
Michigan	19,322	100	72	25	3	..	2,589	100	33	45	22	..
Minnesota	19,344	100	5	52	43	..	3,086	100	32	54	14	..
Wisconsin	16,535	100	25	69	6	(3/)	1,888	100	24	69	7	(3/)
Total	55,201	100	34	48	18	(3/)	7,563	100	30	55	15	(3/)
Central:												
Illinois	3,993	100	..	19	81	..	241	100	..	60	40	..
Indiana	4,103	100	..	42	58	..	172	100	..	100	..	..
Iowa	1,990	100	..	49	51	..	22	100	..	..	100	..
Kentucky	11,497	57	7	22	28	43	723	100	7	93	..	..
Missouri	15,177	59	11	7	41	41	1,352	100	..	78	22	(3/)
Ohio	5,067	100	..	66	34	..	94	100	..	43	57	..
Total	41,827	73	6	25	42	27	2,604	100	2	80	18	(3/)
Plains:												
Kansas	1,668	100	..	(3/)	100	..	1	100	..	100	..	..
Nebraska	1,480	100	2	1	97	..	37	100	81	19	..	..
North Dakota	942	..	..	..	..	100	34	..	..	..	..	100
Oklahoma (West)	4,302	16	..	(3/)	16	84	850	43	..	1	42	57
South Dakota (East)	776	88	5	24	59	12	290	100	5	1	94	..
Texas (West)	26,000	1	(3/)	(3/)	1	99	1,108	34	3	3	28	66
Total	35,168	14	(3/)	1	13	86	2,320	46	3	2	41	54
Total North	208,468	80	29	33	18	20	15,151	92	31	44	17	8
South:												
South Atlantic:												
North Carolina	19,513	90	(3/)	79	11	10	1,710	100	2	87	11	(3/)
South Carolina	11,943	100	(3/)	53	47	..	768	100	1	86	13	..
Virginia	15,832	100	3	97	(3/)	..	1,799	100	23	77	(3/)	..
Total	47,288	96	1	78	17	4	4,277	100	11	82	7	(3/)

Section, region, and State	State, county, and municipal: Total	State, county, and municipal: Total	Protected[2]: Class 1	Protected[2]: Class 2	Protected[2]: Class 3	Unprotected	Private: Total	Private: Total	Protected[2]: Class 1	Protected[2]: Class 2	Protected[2]: Class 3	Unprotected
	Thousand acres	Percent	Percent	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Percent	Percent
North:												
New England:												
Connecticut	170	100	100	..	..	..	1,819	100	100	(3/)	..	..
Maine	407	100	..	100	..	..	16,566	100	..	100	..	..
Massachusetts	391	100	100	..	..	..	2,861	100	..	100	..	..
New Hampshire	101	100	51	49	..	..	4,078	100	49	51	..	..
Rhode Island	30	100	67	33	..	..	404	100	4	94	2	..
Vermont	98	100	100	..	..	..	3,419	100	100	..	..	..
Total	1,197	100	61	39	..	..	29,147	100	25	75	(3/)	..
Middle Atlantic:												
Delaware	12	100	58	42	..	..	441	100	57	43	..	..
Maryland	164	100	100	..	..	..	2,686	100	100	..	..	..
New Jersey	196	100	78	22	..	..	1,729	100	49	51	..	..
New York	3,176	100	78	22	..	..	11,149	100	37	53	10	..
Pennsylvania	2,811	100	100	..	..	..	11,893	100	100	..	..	..
West Virginia	123	100	45	37	18	..	8,884	100	34	10	56	..
Total	6,482	100	88	12	(3/)	..	36,782	100	62	21	17	..
Lake States:												
Michigan	4,194	100	94	6	..	..	12,539	100	72	28	..	..
Minnesota	7,103	100	..	51	49	..	9,155	100	..	51	49	..
Wisconsin	2,414	100	25	75	..	..	12,233	100	25	68	7	..
Total	13,711	100	33	42	25	..	33,927	100	36	48	16	..
Central:												
Illinois	47	100	..	100	..	..	3,705	100	..	15	85	..
Indiana	86	100	..	100	..	..	3,845	100	..	38	62	..
Iowa	13	100	..	100	..	..	1,955	100	..	50	50	..
Kentucky	53	100	58	42	..	..	10,721	54	7	17	30	46
Missouri	241	100	1	..	99	..	13,584	54	12	..	42	46
Ohio	107	100	..	94	6	..	4,866	100	..	66	34	..
Total	547	100	6	49	45	..	38,676	71	6	21	44	29
Plains:												
Kansas	..	..	..	..	..	..	1,667	100	..	..	100	..
Nebraska	24	100	..	..	100	..	1,419	100	..	..	100	..
North Dakota	10	..	..	..	..	100	898	..	..	..	..	100
Oklahoma (West)	186	10	..	..	10	90	3,266	10	..	..	10	90
South Dakota (East)	21	100	100	..	..	..	465	80	..	40	40	20
Texas (West)	37	38	..	..	38	62	24,855	..	..	..	..	100
Total	278	28	7	..	21	72	32,570	12	..	1	11	88
Total North	22,215	99	49	33	17	1	171,102	77	26	32	19	23
South:												
South Atlantic:												
North Carolina	348	100	..	79	21	..	17,455	89	..	78	11	11
South Carolina	198	100	..	51	49	..	10,977	100	..	51	49	..
Virginia	100	100	..	100	..	..	13,933	100	..	100	..	..
Total	646	100	..	74	26	..	42,365	96	..	78	18	4

Table 16.--Commercial and noncommercial forest land requiring protection from fire in the United States and Coastal Alaska, and status of protection by ownership class and by section, region, and State, 1952[1]--Continued

Section, region, and State	All ownerships: Total	All ownerships: Protected[2] Total	Protected Class 1	Protected Class 2	Protected Class 3	Unprotected	Federal ownership or trusteeship: Total	Federal: Protected[2] Total	Protected Class 1	Protected Class 2	Protected Class 3	Unprotected
	Thousand acres	Percent	Percent	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Percent	Percent
South:--Continued												
Southeast:												
Alabama	20,771	100	..	33	67	(3/)	794	99	(3/)	89	10	1
Florida	23,047	71	..	63	8	29	2,053	97	..	88	9	3
Georgia	24,057	80	2	76	2	20	1,639	100	..	85	15	..
Mississippi	16,473	78	..	46	32	22	1,264	99	..	90	9	1
Tennessee	12,558	82	(3/)	25	57	18	1,085	100	3	88	9	..
Total	96,906	82	1	51	30	18	6,835	99	1	88	10	1
West Gulf:												
Arkansas	19,346	80	(3/)	79	1	20	2,840	97	(3/)	91	6	3
Louisiana	15,990	76	5	43	28	24	746	99	..	84	15	1
Oklahoma (East)	6,027	66	(3/)	32	34	34	283	96	3	67	26	4
Texas (East)	11,708	78	(3/)	63	15	22	738	99	3	89	7	1
Total	53,071	77	2	59	16	23	4,607	98	1	88	9	2
Total South	197,265	84	1	60	23	16	15,719	99	4	86	9	1
West:												
Pacific Northwest:												
Oregon	30,261	100	1	96	3	..	18,087	100	1	98	1	..
Washington	23,870	100	1	95	4	..	11,580	100	(3/)	97	3	..
Total	54,131	100	1	96	3	..	29,667	100	1	98	1	..
California	52,082	100	12	42	46	..	24,471	100	13	34	53	..
Northern Rocky Mtn:												
Idaho	21,025	100	19	73	8	..	16,339	100	18	75	7	..
Montana	22,330	100	15	69	16	..	16,457	100	13	77	10	..
S. Dak. (West)	1,393	100	26	73	1	..	1,029	100	35	65	..	..
Wyoming	10,513	99	12	60	27	1	9,950	100	12	62	26	..
Total	55,261	100	16	69	15	(3/)	43,775	100	16	72	12	..
Southern Rocky Mtn:												
Arizona	19,212	92	3	52	37	8	15,946	100	4	58	38	..
Colorado	20,834	88	50	34	4	12	15,755	100	61	37	2	..
Nevada	12,036	99	30	62	7	1	11,644	100	31	63	6	..
New Mexico	21,329	76	(3/)	54	22	24	11,944	100	1	86	13	..
Utah	16,219	100	33	56	11	..	14,610	100	34	57	9	..
Total	89,630	90	22	51	17	10	69,899	100	27	59	14	..
Total West	251,104	96	14	62	20	4	167,812	100	17	66	17	..
Continental U. S.	656,837	87	15	52	20	13	198,682	99	17	66	16	1
Coastal Alaska	16,508	100	5	81	14	..	16,446	100	5	81	14	..
All Regions	673,345	88	15	53	20	12	215,128	99	16	67	16	1

Section, region, and State	State, county, and municipal: Total	State, county, and municipal: Protected[2] Total	Protected Class 1	Protected Class 2	Protected Class 3	Unprotected	Private: Total	Private: Protected[2] Total	Protected Class 1	Protected Class 2	Protected Class 3	Unprotected
	Thousand acres	Percent	Percent	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Percent	Percent
South:--Continued												
Southeast:												
Alabama	177	100	..	30	70	..	19,800	100	..	31	69	..
Florida	560	86	..	43	43	14	20,434	68	..	61	7	32
Georgia	126	100	2	76	22	..	22,292	79	3	75	1	21
Mississippi	482	81	..	47	34	19	14,727	77	..	43	34	23
Tennessee	345	100	..	25	75	..	11,128	80	..	19	61	20
Total	1,690	90	(3/)	42	48	10	88,381	81	1	49	31	19
West Gulf:												
Arkansas	120	100	..	72	28	..	16,386	77	..	77	..	23
Louisiana	187	100	..	74	26	..	15,057	74	5	41	28	26
Oklahoma (East)	99	100	..	..	100	..	5,645	64	..	31	33	36
Texas (East)	35	100	..	66	34	..	10,935	77	..	62	15	23
Total	441	100	..	56	44	..	48,023	75	3	56	16	25
Total South	2,777	94	(3/)	52	42	6	178,769	83	1	58	24	17
West:												
Pacific Northwest:												
Oregon	1,156	100	..	90	10	..	11,018	100	2	93	5	..
Washington	2,225	100	..	96	4	..	10,065	100	3	91	6	..
Total	3,381	100	..	94	6	..	21,083	100	2	92	6	..
California	245	100	41	59	..	..	27,366	100	11	49	40	..
Northern Rocky Mtn:												
Idaho	1,080	100	25	69	6	..	3,606	100	23	65	12	..
Montana	739	100	19	71	10	..	5,134	100	19	42	39	..
S. Dak. (West)	18	100	..	100	..	..	346	100	..	95	5	..
Wyoming	100	51	3	10	38	49	463	94	2	42	50	6
Total	1,937	97	21	67	9	3	9,549	99	19	52	28	1
Southern Rocky Mtn:												
Arizona	..	..	..	..	..	..	3,266	51	..	21	30	49
Colorado	2,614	27	1	21	5	73	2,465	74	24	32	18	26
Nevada	..	..	..	..	..	..	392	80	..	52	28	20
New Mexico	..	..	..	..	..	..	9,385	47	..	15	32	53
Utah	354	100	15	57	28	..	1,255	100	20	44	36	..
Total	2,968	36	3	25	8	64	16,763	56	5	21	30	44
Total West	8,531	77	7	63	7	23	74,761	90	8	56	26	10
Continental U. S.	33,523	93	34	42	17	7	424,632	81	12	47	22	19
Coastal Alaska	..	..	..	..	..	..	62	100	8	84	8	..
All Regions	33,523	93	34	42	17	7	424,694	81	12	47	22	19

1/ Prepared by Forest Service, U. S. Department of Agriculture. The total forest land area requiring protection consists of 487,710 thousand acres of commercial forest land exclusive of 520 thousand acres in Iowa and 379 thousand acres in Ohio not needing protection, and 175,585 thousand acres of noncommercial forest land. In addition, 9,541 thousand acres of nonforest land in California and 509 thousand acres in North Dakota are included for these States. Nonforest land requiring protection because of watershed values or because of adjacent timber or watershed values are not included for other States.

2/ Class of protection: Class 1, protection adequate to meet the fire situation in worst years and under serious peak load conditions; Class 2, protection adequate to meet the average fire situation but failures likely in the worst years and under peak load conditions; Class 3, protection adequate to meet fire situation in the easy years and failures frequent in average or worse years.

3/ Less than 0.5 percent.

Table 17.--Annual mortality of live sawtimber and growing stock on commercial forest land in the United States and Coastal Alaska, by cause, by section, region, and State, and by softwoods and hardwoods, 1952 1/

Section, region, and State	Growing stock							Live sawtimber						
	Total	Softwood	Hardwood	Mortality cause: Fire	Mortality cause: Insects	Mortality cause: Disease	Mortality cause: Other 2/	Total	Softwood	Hardwood	Mortality cause: Fire	Mortality cause: Insects	Mortality cause: Disease	Mortality cause: Other 2/
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
North:														
New England:														
Connecticut	7	1	6	2	(3/)	1	4	4	1	3	2	(4/)	2	(4/)
Maine	196	48	148	1	10	154	31	402	127	275	3	30	303	66
Massachusetts	20	11	9	1	6	8	5	30	26	4	(4/)	3	21	6
New Hampshire	52	29	23	(3/)	5	42	5	140	84	56	1	12	117	10
Rhode Island	1	(3/)	1	(3/)	..	(3/)	1	[illegible]	1	1	1	..	(4/)	1
Vermont	22	10	12	(3/)	2	13	7	67	29	38	(4/)	8	32	27
Total	298	99	199	4	23	218	53	645	268	377	7	53	475	110
Middle Atlantic:														
Delaware	4	2	2	(3/)	..	(3/)	4	4	3	1	(4/)	..	(4/)	4
Maryland	16	9	7	1	(3/)	1	14	21	10	11	[illegible]	1	4	14
New Jersey	5	3	2	(3/)	(3/)	2	3	6	2	4	1	(4/)	1	4
New York	104	34	70	4	3	21	76	147	61	86	4	10	63	70
Pennsylvania	85	15	70	2	4	12	67	103	36	67	1	8	30	64
West Virginia	19	1	18	1	1	3	14	73	3	70	2	5	9	57
Total	233	64	169	8	8	39	178	354	115	239	10	24	107	213
Lake States:														
Michigan	136	24	112	1	13	43	79	278	61	217	1	7	63	207
Minnesota	173	68	105	1	14	69	89	194	88	106	2	11	68	113
Wisconsin	176	30	146	(3/)	7	54	115	226	60	166	(4/)	2	62	162
Total	485	122	363	2	34	166	283	698	209	489	3	20	193	482
Central:														
Illinois	15	(3/)	15	1	..	5	9	59	(4/)	59	2	..	19	38
Indiana	7	(3/)	7	1	..	2	4	19	(4/)	19	[illegible]	..	8	9
Iowa	12	(3/)	12	1	..	4	7	40	..	40	4	..	18	18
Kentucky	30	2	28	6	..	9	15	90	7	83	13	..	27	50
Missouri	30	2	28	11	..	6	13	79	5	74	23	..	28	28
Ohio	8	(3/)	8	1	..	3	4	25	1	24	2	..	11	12
Total	102	4	98	21	..	29	52	312	13	299	46	..	111	155
Plains:														
Kansas	9	(3/)	9	1	..	3	5	32	(4/)	32	3	..	14	15
Nebraska	5	1	4	(3/)	..	1	4	12	2	10	1	..	6	5
North Dakota	5	(3/)	5	(3/)	(3/)	3	2	10	(4/)	10	(4/)	1	5	4
Oklahoma (West)	2	..	2	(3/)	(3/)	(3/)	2	5	..	5	1	(4/)	(4/)	4
S. Dak. (East)	5	(3/)	5	(3/)	(3/)	2	3	7	1	6	..	..	3	4
Texas (West)	2	1	1	(3/)	(3/)	(3/)	2	4	2	2	(4/)	1	(4/)	3
Total	28	2	26	1	(3/)	9	18	70	5	65	5	2	28	35
Total North	1,146	291	855	36	65	461	584	2,079	610	1,469	71	99	914	995
South:														
South Atlantic:														
North Carolina	35	23	12	6	9	7	13	98	68	30	17	26	25	30
South Carolina	39	30	9	6	10	8	15	127	101	26	23	37	32	35
Virginia	21	11	10	4	4	5	8	42	22	20	7	9	11	15
Total	95	64	31	16	23	20	36	267	191	76	47	72	68	80
Southeast:														
Alabama	82	39	43	10	13	12	47	229	131	98	19	56	32	122
Florida	40	30	10	11	5	7	17	117	88	29	22	22	23	50
Georgia	80	51	29	23	11	15	31	242	152	90	66	38	51	87
Mississippi	70	23	47	14	10	4	42	159	68	91	25	32	11	91
Tennessee	42	6	36	13	3	2	24	94	16	78	22	8	7	57
Total	314	149	165	71	42	40	161	841	455	386	154	156	124	407
West Gulf:														
Arkansas	82	29	53	16	13	5	48	226	104	122	36	48	15	127
Louisiana	76	26	50	14	15	5	42	248	109	139	40	61	19	128
Oklahoma (East)	12	4	8	2	2	1	7	33	13	20	3	9	2	19
Texas (East)	50	26	24	7	17	2	24	153	100	53	14	66	5	68
Total	220	85	135	39	47	13	121	660	326	334	93	184	41	342
Total South	629	298	331	126	112	73	318	1,768	972	796	294	412	233	829
West:														
Pacific Northwest:														
D.-fir subregion	551	537	14	34	225	62	230	3,105	3,056	49	189	1,313	369	1,234
Pine subregion	196	196	..	..	89	16	91	932	932	..	4	422	75	431
Total	747	733	14	34	314	78	321	4,037	3,988	49	193	1,735	444	1,665
Oregon	393	386	7	23	170	40	160	2,314	2,287	27	129	1,037	253	895
Washington	354	347	7	11	144	38	161	1,723	1,701	22	64	698	191	770
Total	747	733	14	34	314	78	321	4,037	3,988	49	193	1,735	444	1,665
California	359	336	23	21	228	45	65	1,865	1,811	54	131	1,358	204	172
Northern Rocky Mtn:														
Idaho	153	153	(3/)	5	77	30	41	714	713	1	20	399	95	200
Montana	123	122	1	2	75	6	40	630	630	(4/)	7	408	30	185
S. Dak. (West)	4	4	..	(3/)	1	(3/)	3	15	15	(4/)	(4/)	3	(4/)	12
Wyoming	28	27	1	(3/)	5	(3/)	23	116	114	2	(4/)	23	9	84
Total	308	306	2	7	158	36	107	1,475	1,472	3	27	833	134	481
Southern Rocky Mtn:														
Arizona	46	44	2	4	13	8	21	240	234	6	24	63	39	114
Colorado	73	67	6	(3/)	27	5	41	275	266	9	2	121	24	128
Nevada	1	1	(3/)	(3/)	1	(3/)	(3/)	5	5	(4/)	1	3	(4/)	1
New Mexico	68	57	11	7	18	14	29	334	298	36	35	84	67	148
Utah	12	10	2	(3/)	7	4	1	52	46	6	1	27	16	8
Total	200	179	21	11	66	31	92	906	849	57	63	298	146	399
Total West	1,614	1,554	60	73	766	190	585	8,283	8,120	163	414	4,224	928	2,717
Continental U. S.	3,389	2,143	1,246	235	943	724	1,487	12,130	9,702	2,428	779	4,735	2,075	4,541
Coastal Alaska	100	100	(3/)	1	27	49	23	392	392	(4/)	2	98	204	88
All Regions	3,489	2,243	1,246	236	970	773	1,510	12,522	10,094	2,428	781	4,833	2,279	4,629

1/ Prepared by Forest Service, U. S. Department of Agriculture. Mortality of live sawtimber in board feet log scale, International 1/4-inch rule, and of growing stock in cubic feet excluding bark. Estimates represent the current level of mortality indicated by trends over a long period of years as determined in 1952.

2/ Weather, animals, suppression, etc.

3/ Less than 0.5 million cubic feet.

4/ Less than 0.5 million board feet.

Table 18.--Area of acceptable plantations on commercial and noncommercial forest land and area of shelterbelts in continental United States by ownership class, and by section, region and State, June 30, 1952[1/]

Section, region, and State	Total all land	Commercial forest land									Noncommercial forest land									Shelterbelts						
		Total	Federal ownership or trusteeship					State	County and municipal	Private	Total	Federal ownership or trusteeship					State	County and municipal	Private	Total	Federal ownership or trusteeship			State	County and municipal	Private
			Total	National forest	Bureau of land management	Indian	Other					Total	National forest	Bureau of land management	Indian	Other					Total	Indian	Other			
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
North:																										
New England:																										
Connecticut	30.0	30.0	..	..	..	..	..	9.0	3.0	18.0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Maine	17.2	17.2	0.1	0.1	..	..	..	.4	.6	16.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Massachusetts	50.0	50.0	.7	..	..	..	0.7	30.0	8.3	11.0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
New Hampshire	20.6	20.6	1.0	1.0	..	..	..	4.8	2.6	12.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rhode Island	12.0	12.0	..	..	..	..	..	1.0	6.0	5.0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Vermont	29.7	29.7	1.4	1.4	..	..	..	3.2	3.3	21.8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	159.5	159.5	3.2	2.5	..	..	.7	48.4	23.8	84.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Middle Atlantic:																										
Delaware	.7	.7	(2/)	..	..	..	(2/)	.2	.1	.4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Maryland	17.3	17.3	..	..	..	..	..	1.7	1.4	14.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
New Jersey	18.0	18.0	..	..	..	..	..	5.0	.7	12.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
New York	575.0	532.0	..	..	..	..	..	285.0	68.0	179.0	43.0	..	..	..	..	..	38.0	5.0	..	..	..	..	..	..	..	..
Pennsylvania	185.0	185.0	12.2	12.2	..	..	..	50.0	8.0	114.8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
West Virginia	26.9	26.9	14.7	14.7	..	..	..	1.2	.2	10.8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	822.9	779.9	26.9	26.9	..	..	(2/)	343.1	78.4	331.5	43.0	..	..	..	..	..	38.0	5.0	..	..	..	..	..	..	..	..
Lake States:																										
Michigan	761.0	751.2	380.2	376.0	..	0.2	4.0	268.0	10.0	93.0	4.8	3.8	..	..	..	3.8	..	..	1.0	5.0	..	..	..	..	..	5.0
Minnesota	212.2	200.0	100.7	96.0	..	4.0	.7	33.4	3.9	62.0	.7	.7	..	..	..	.7	..	..	..	11.5	..	..	..	..	..	11.5
Wisconsin	450.4	440.1	171.1	166.0	..	1.8	3.3	37.0	111.0	121.0	4.3	3.3	..	..	..	3.3	..	..	1.0	6.0	..	..	..	..	..	6.0
Total	1,423.6	1,391.3	652.0	638.0	..	6.0	8.0	338.4	124.9	276.0	9.8	7.8	..	..	..	7.8	..	..	2.0	22.5	..	..	..	..	..	22.5
Central:																										
Illinois	83.7	75.9	32.5	30.5	..	..	2.0	6.6	..	36.8	6.0	3.2	..	..	..	3.2	..	1.8	1.0	1.8	..	..	..	..	..	1.8
Indiana	71.8	61.3	13.6	11.4	..	..	2.2	11.8	..	35.9	2.5	2.1	..	..	..	2.1	..	.4	..	8.0	..	..	..	..	..	8.0
Iowa	45.8	14.0	(2/)	..	..	(2/)	..	2.4	..	11.6	6.8	..	..	..	..	..	2.5	.3	4.0	25.0	..	..	..	..	..	25.0
Kentucky	12.1	12.1	.4	.4	..	..	..	1.0	.1	10.6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Missouri	58.1	56.2	45.8	45.7	..	..	.1	2.3	..	8.1	.9	.2	..	..	..	.2	..	(2/)	.7	1.0	..	..	..	..	..	1.0
Ohio	70.2	63.1	9.0	7.0	..	..	2.0	11.9	7.2	35.0	5.9	1.9	..	..	..	1.9	..	1.0	3.0	1.2	..	..	..	..	..	1.2
Total	341.7	282.6	101.3	95.0	..	(2/)	6.3	36.0	7.3	138.0	22.1	7.4	..	..	..	7.4	2.5	3.5	8.7	37.0	..	..	..	..	..	37.0
Plains:																										
Kansas	152.6	17.0	..	..	..	..	..	2.0	..	15.0	3.6	.1	..	..	..	.1	..	..	3.5	132.0	..	..	..	.3	.2	131.5
Nebraska	216.8	21.0	16.0	16.0	..	..	..	..	..	5.0	7.8	.1	..	..	..	.1	.3	.4	7.0	188.0	..	..	..	..	..	188.0
North Dakota	66.7	.8	..	..	..	..	..	..	..	.8	.8	..	..	..	..	..	..	..	.8	65.1	1.4	.1	1.3	.3	(2/)	63.4
Oklahoma (West)	22.4	7.0	..	..	..	..	..	..	..	7.0	..	..	..	..	..	..	..	..	..	15.4	..	..	..	..	..	15.4
S. Dak. (East)	67.5	10.0	..	..	..	..	..	..	..	10.0	.7	..	..	..	..	..	.7	..	..	56.8	1.0	1.0	(2/)	..	.8	55.0
Texas (West)	25.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	25.1	..	..	..	..	..	25.1
Total	551.1	55.8	16.0	16.0	..	..	..	2.0	..	37.8	12.9	.2	..	..	..	.2	1.0	.4	11.3	482.4	2.4	1.1	1.3	.6	1.0	478.4
Total North	3,298.8	2,669.1	799.4	778.4	..	6.0	15.0	767.9	234.4	867.4	87.8	15.4	..	..	..	15.4	41.5	8.9	22.0	541.9	2.4	1.1	1.3	.6	1.0	537.9
South:																										
South Atlantic:																										
North Carolina	80.9	80.9	12.6	5.9	..	.1	6.6	2.8	.7	64.8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
South Carolina	186.4	186.4	27.9	15.8	..	..	12.1	11.8	1.0	145.7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Virginia	33.1	33.1	1.1	1.1	..	..	..	2.5	.7	28.8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	300.4	300.4	41.6	22.8	..	.1	18.7	17.1	2.4	239.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table 18.--Area of acceptable plantations on commercial and noncommercial forest land and area of shelterbelts in continental United States by ownership class and by section, region and State, June 30, 1952[1/]--Continued

Section, region, and State	Total all land	Commercial forest land									Noncommercial forest land									Shelterbelts						
		Total	Federal ownership or trusteeship					State	County and municipal	Private	Total	Federal ownership or trusteeship					State	County and municipal	Private	Total	Federal ownership or trusteeship			State	County and municipal	Private
			Total	National forest	Bureau of land management	Indian	Other					Total	National forest	Bureau of land management	Indian	Other					Total	Indian	Other			
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
South:--Continued																										
Southeast:																										
Alabama	156.8	156.8	57.9	36.3	..	..	21.6	2.7	.2	96.0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Florida	227.0	227.0	21.8	9.0	..	..	12.8	4.0	.6	200.6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Georgia	344.4	344.4	8.5	3.4	..	..	5.1	3.7	2.0	330.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mississippi	256.3	256.3	134.6	129.2	..	..	5.4	2.2	.2	119.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tennessee	197.0	197.0	47.6	3.3	..	..	44.3	20.4	.6	128.4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	1,181.5	1,181.5	270.4	181.2	..	..	89.2	33.0	3.6	874.5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
West Gulf:																										
Arkansas	76.6	76.6	13.4	9.6	..	..	3.8	.1	.4	62.7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Louisiana	291.1	291.1	80.3	76.9	..	..	3.4	3.9	2.1	204.8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Oklahoma (East)	6.9	6.9	3.6	..	..	..	3.6	.3	(2/)	3.0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Texas (East)	120.2	120.2	37.3	36.5	..	..	.8	.8	1.9	80.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	494.8	494.8	134.6	123.0	..	..	11.6	5.1	4.4	350.7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total South	1,976.7	1,976.7	446.6	327.0	..	.1	119.5	55.2	10.4	1,464.5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
West:																										
Pacific Northwest:																										
Oregon	174.8	174.7	76.1	61.6	14.4	..	.1	45.5	.3	52.8	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	.1
Washington	202.3	201.7	88.2	82.5	..	5.4	.3	30.6	5.0	77.9	..	..	..	..	..	..	..	..	..	.6	..	..	..	..	..	.6
Total	377.1	376.4	164.3	144.1	14.4	5.4	.4	76.1	5.3	130.7	..	..	..	..	..	..	..	..	..	.7	..	..	..	..	..	.7
California	36.0	26.0	17.0	16.9	..	(2/)	.1	..	..	9.0	5.0	(2/)	(2/)	..	..	..	..	..	5.0	5.0	..	..	..	..	..	5.0
Northern Rocky Mtn:																										
Idaho	82.4	76.7	76.1	76.0	..	(2/)	.1	.5	.1	(2/)	..	..	..	..	..	..	..	..	..	5.7	..	..	..	..	..	5.7
Montana	30.6	22.6	22.3	21.9	..	..	.4	..	(2/)	.3	..	..	..	..	..	..	..	..	..	8.0	..	..	..	..	..	8.0
S. Dak. (West)	16.7	12.7	12.6	12.6	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	4.0	..	..	..	..	..	4.0
Wyoming	13.0	2.7	2.7	2.7	(2/)	..	..	..	..	..	(2/)	..	..	..	..	..	..	..	(2/)	10.3	.3	.1	.2	.1	(2/)	9.9
Total	142.7	114.7	113.7	113.2	(2/)	(2/)	.5	.6	.1	.3	(2/)	..	..	..	..	..	..	..	(2/)	28.0	.3	.1	.2	.1	(2/)	27.6
Southern Rocky Mtn:																										
Arizona	4.6	4.1	3.2	.3	..	.1	2.8	..	..	.9	..	..	..	..	..	..	..	..	..	.5	(2/)	..	(2/)	..	..	.5
Colorado	48.7	37.4	37.4	37.4	..	..	..	..	..	..	2.3	.7	(2/)	.3	.3	.1	(2/)	..	1.6	9.0	..	..	..	..	(2/)	9.0
Nevada	.1	(2/)	(2/)	(2/)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	.1
New Mexico	6.3	4.1	2.9	.4	..	.3	2.2	..	..	1.2	..	..	..	..	..	..	..	..	..	2.2	(2/)	..	(2/)	..	..	2.2
Utah	3.9	1.6	1.6	1.6	..	..	(2/)	..	..	(2/)	.3	..	..	..	..	..	..	..	.3	2.0	(2/)	(2/)	..	(2/)	(2/)	2.0
Total	63.6	47.2	45.1	39.7	..	.4	5.0	..	..	2.1	2.6	.7	(2/)	.3	.3	.1	(2/)	..	1.9	13.8	(2/)	(2/)	(2/)	(2/)	(2/)	13.8
Total West	619.4	564.3	340.1	313.9	14.4	5.8	6.0	76.7	5.4	142.1	7.6	.7	(2/)	.3	.3	.1	(2/)	..	6.9	47.5	.3	.1	.2	.1	(2/)	47.1
Continental U. S.	5,894.9	5,210.1	1,586.1	1,419.3	14.4	11.9	140.5	899.8	250.2	2,474.0	95.4	16.1	(2/)	.3	.3	15.5	41.5	8.9	28.9	589.4	2.7	1.2	1.5	.7	1.0	585.0

1/ Prepared by Forest Service, U. S. Department of Agriculture. To qualify as acceptable, plantations must have at the end of the fifth year after planting the following number of planted trees per plantation acre: Engelmann spruce and lodgepole pine 300; other western species, 200; all eastern species 400.

2/ Less than 0.05 thousand acres.

Table 19.--Plantable area of commercial and noncommercial forest land and needed shelterbelt plantings in continental United States, by ownership class, and by section, region, and State, January 1, 1953[1/]

Section, region, and State	Total all land	Commercial forest land: Total	Commercial: Federal ownership or trusteeship: Total	Commercial: Federal: National forest	Commercial: Federal: Bureau of land management	Commercial: Federal: Indian	Commercial: Federal: Other	Commercial: State	Commercial: County and municipal	Commercial: Private	Noncommercial forest land: Total	Noncommercial: Federal ownership or trusteeship: Total	Noncommercial: Federal: National forest	Noncommercial: Federal: Bureau of land management	Noncommercial: Federal: Indian	Noncommercial: Federal: Other	Noncommercial: State	Noncommercial: County and municipal	Noncommercial: Private	Shelterbelts: Total	Shelterbelts: Federal ownership or trusteeship: Total	Shelterbelts: Federal: Indian	Shelterbelts: Federal: Other	Shelterbelts: County and municipal	Shelterbelts: Private
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
North:																									
New England:																									
Connecticut	205	205	..	..	..	..	..	35	..	170	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Maine	476	474	2	..	..	..	2	..	12	460	2	2	..	..	..	2	..	..	..	..	..	..	..	..	..
Massachusetts	115	100	1	..	..	..	1	12	3	84	15	..	..	..	..	..	1	..	14	..	..	..	..	..	..
New Hampshire	310	310	1	..	..	..	1	4	22	283	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rhode Island	39	38	..	..	..	..	..	4	..	34	1	..	..	..	..	..	1	..	..	..	..	..	..	..	..
Vermont	101	101	2	2	..	..	..	1	1	97	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	1,246	1,228	6	2	..	..	4	56	38	1,128	18	2	..	..	..	2	2	..	14	..	..	..	..	..	..
Middle Atlantic:																									
Delaware	34	34	..	..	..	..	..	2	..	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Maryland	250	250	..	..	..	..	..	3	5	242	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
New Jersey	93	91	..	..	..	..	..	1	1	89	2	..	..	..	..	..	1	..	1	..	..	..	..	..	..
New York	1,250	1,250	..	..	..	..	..	30	5	1,215	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pennsylvania	1,100	1,100	20	20	..	..	..	20	5	1,055	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
West Virginia	1,000	1,000	11	11	..	..	..	10	..	979	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	3,727	3,725	31	31	..	..	..	66	16	3,612	2	..	..	..	..	..	1	..	1	..	..	..	..	..	..
Lake States:																									
Michigan	3,176	2,870	246	245	..	1	..	250	50	2,324	256	25	25	..	..	..	35	30	166	50	..	..	..	..	50
Minnesota	2,521	2,261	111	96	..	15	..	200	400	1,550	160	..	..	..	..	..	30	30	100	100	..	..	..	..	100
Wisconsin	2,790	2,520	80	63	..	4	13	900	160	1,380	220	25	25	..	..	..	35	30	130	50	..	..	..	..	50
Total	8,487	7,651	437	404	..	20	13	1,350	610	5,254	636	50	50	..	..	..	100	90	396	200	..	..	..	..	200
Central:																									
Illinois	2,893	2,791	32	29	..	..	3	8	1	2,750	100	5	5	..	..	..	11	11	73	2	..	..	..	..	2
Indiana	1,345	1,282	55	43	..	..	12	25	2	1,200	55	..	..	..	..	..	15	15	25	8	..	..	..	..	8
Iowa	613	426	..	..	..	..	..	1	1	424	112	..	..	..	..	..	10	10	92	75	..	..	..	..	75
Kentucky	1,500	1,500	..	..	..	..	..	4	1	1,495	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Missouri	1,305	1,240	38	37	..	..	1	2	..	1,200	30	..	..	..	..	..	10	10	10	35	..	..	..	..	35
Ohio	739	630	10	10	..	..	..	10	10	600	105	..	..	..	..	..	20	50	35	4	..	..	..	..	4
Total	8,395	7,869	135	119	..	..	16	50	15	7,669	402	5	5	..	..	..	66	96	235	124	..	..	..	..	124
Plains:																									
Kansas	915	350	..	..	..	..	..	15	10	325	135	..	..	..	..	..	..	..	135	430	..	..	..	30	400
Nebraska	982	224	14	14	..	..	..	8	2	200	70	..	..	..	..	..	..	..	70	688	..	..	..	28	660
North Dakota	742	58	..	..	..	..	..	..	..	58	20	..	..	..	..	..	..	..	20	664	..	..	..	..	664
Oklahoma (West)	471	180	..	..	..	..	..	..	..	180	161	..	..	..	..	..	..	..	161	130	..	..	..	..	130
S. Dak. (East)	599	138	8	..	..	..	8	..	..	130	61	1	..	1	..	..	..	..	60	400	..	..	..	..	400
Texas (West)	51	25	..	..	..	..	..	..	1	24	1	..	..	..	..	..	..	..	1	25	..	..	..	1	24
Total	3,760	975	22	14	..	..	8	23	13	917	448	1	..	1	..	..	..	..	447	2,337	..	..	..	59	2,278
Total North	25,615	21,448	631	570	..	20	41	1,545	692	18,580	1,506	58	55	1	..	2	169	186	1,093	2,661	..	..	..	59	2,502
South:																									
South Atlantic:																									
North Carolina	970	970	72	58	..	1	13	40	5	853	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
South Carolina	1,311	1,311	142	9	..	..	133	63	..	1,106	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Virginia	1,800	1,800	1	1	..	..	..	10	..	1,789	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	4,081	4,081	215	68	..	1	146	113	5	3,748	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Southeast:																									
Alabama	1,734	1,734	59	46	..	..	13	45	..	1,630	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Florida	5,070	5,070	211	110	..	1	100	22	5	4,832	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Georgia	1,574	1,574	8	3	..	..	5	3	..	1,563	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mississippi	4,343	4,343	156	101	4	2	49	24	127	4,036	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tennessee	1,493	1,493	28	3	..	..	25	25	..	1,440	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	14,214	14,214	462	263	4	3	192	119	132	13,501	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table 19.--Plantable area of commercial and noncommercial forest land and needed shelterbelt plantings in continental United States, by ownership class, and by section, region, and State, January 1, 1953[1]--Continued

Section, region, and State	Total all land	Commercial forest land									Noncommercial forest land									Shelterbelts					
		Total	Federal ownership or trusteeship					State	County and municipal	Private	Total	Federal ownership or trusteeship					State	County and municipal	Private	Total	Federal ownership or trusteeship			County and municipal	Private
			Total	National forest	Bureau of land management	Indian	Other					Total	National forest	Bureau of land management	Indian	Other					Total	Indian	Other		
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
South:--Continued																									
West Gulf:																									
Arkansas	1,515	1,515	107	73	3	..	31	..	3	1,405	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Louisiana	1,224	1,224	85	70	..	..	15	..	25	1,114	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Oklahoma (East)	413	413	8	1	..	5	2	..	..	405	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Texas (East)	500	500	12	2	..	..	10	2	1	485	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	3,652	3,652	212	146	3	5	58	2	29	3,409	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total South	21,947	21,947	889	477	7	9	396	234	166	20,658	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
West:																									
Pacific Northwest:																									
Oregon	1,777	1,538	588	393	169	8	18	181	75	694	237	220	185	15	10	10	11	..	6	2	..	..	..	..	2
Washington	1,055	930	197	151	..	32	14	168	70	495	117	107	82	..	15	10	6	..	4	8	..	..	..	..	8
Total	2,832	2,468	785	544	169	40	32	349	145	1,189	354	327	267	15	25	20	17	..	10	10	..	..	..	..	10
California	7,211	4,104	1,987	1,844	..	29	114	37	2	2,078	3,107	1,867	980	880	2	5	40	..	1,200	..	..	..	..	..	..
Northern Rocky Mtn:																									
Idaho	764	734	499	470	22	6	1	58	1	176	..	..	..	..	..	..	..	..	..	30	..	..	..	..	30
Montana	386	336	172	137	4	31	..	19	1	144	..	..	..	..	..	..	..	..	..	50	..	..	..	..	50
S. Dak. (West)	150	42	23	23	..	..	..	2	..	17	58	15	15	..	..	..	13	..	30	50	..	..	..	..	50
Wyoming	164	57	42	36	2	3	1	7	..	8	47	22	10	1	10	1	7	1	17	60	5	5	..	..	55
Total	1,464	1,169	736	666	28	40	2	86	2	345	105	37	25	1	10	1	20	1	47	190	5	5	..	..	185
Southern Rocky Mtn:																									
Arizona	119	96	94	60	2	32	..	..	..	2	19	6	(2/)	..	6	..	..	..	13	4	1	1	..	..	3
Colorado	796	422	316	310	3	2	1	4	2	100	324	183	60	120	1	2	30	1	110	50	2	1	1	1	47
Nevada	38	28	7	7	(2/)	(2/)	..	(2/)	(2/)	21	2	1	1	..	..	..	..	..	1	8	2	1	1	1	5
New Mexico	235	206	131	56	30	38	7	15	..	60	23	7	..	..	6	1	..	..	16	6	..	..	(2/)	..	6
Utah	82	60	41	33	8	(2/)	..	6	..	13	7	4	(2/)	4	..	..	..	..	3	15	..	(2/)	(2/)	..	15
Total	1,270	812	589	466	43	72	8	25	2	196	375	201	61	124	13	3	30	1	143	83	5	3	2	2	76
Total West	12,777	8,553	4,097	3,520	240	181	156	497	151	3,808	3,941	2,432	1,333	1,020	50	29	107	2	1,400	283	10	8	2	2	271
Continental U. S.	60,339	51,948	5,617	4,567	247	210	593	2,276	1,009	43,046	5,447	2,490	1,388	1,021	50	31	276	188	[illegible],493	2,944	10	8	2	61	2,873

1/ Prepared by Forest Service, U. S. Department of Agriculture. Plantable area refers to nonstocked or poorly stocked forest land or nonforest land: (a) on which the establishment or interplanting of forest tree cover is desirable and practical, and (b) on which regeneration will not occur naturally to a desirable density within a reasonable time.
2/ Less than 0.5 thousand acres.

Table 20.--Commercial forest land area in the United States and Coastal Alaska by stand-size class, degree of stocking, and section and region, January 1, 1953[1]

Section and region	All areas	Sawtimber stands					Poletimber stands			Seedling and sapling stands			Nonstocked and other areas
		Total	Old growth[2]	Young growth									
				Total	Well and medium stocked[3]	Poorly stocked[4]	Total	Well and medium stocked[3]	Poorly stocked[4]	Total	Well and medium stocked[3]	Poorly stocked[4]	
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
North:													
New England	30,658	10,302	..	10,302	9,919	383	14,501	13,470	1,031	4,969	4,166	803	886
Middle Atlantic	42,225	15,002	..	15,002	13,948	1,054	16,991	15,438	1,553	8,842	6,619	2,223	1,390
Lake States	53,272	6,457	..	6,457	3,167	3,290	16,010	7,884	8,126	20,370	15,672	4,698	10,435
Central	42,394	14,486	..	14,486	13,327	1,159	15,722	14,068	1,654	8,957	6,926	2,031	3,229
Plains	5,492	1,475	25	1,450	627	823	2,289	1,281	1,008	1,053	329	724	675
Total	174,041	47,722	25	47,697	40,988	6,709	65,513	52,141	13,372	44,191	33,712	10,479	16,615
South:													
South Atlantic	46,152	16,833	..	16,833	15,723	1,110	18,212	16,262	1,950	9,631	8,260	1,371	1,476
Southeast	94,985	24,505	..	24,505	22,766	1,739	37,201	31,176	6,025	21,097	11,956	9,141	12,182
West Gulf	52,151	19,164	..	19,164	18,735	429	22,963	20,338	2,625	7,610	4,467	3,143	2,414
Total	193,288	60,502	..	60,502	57,224	3,278	78,376	67,776	10,600	38,338	24,683	13,655	16,072
West:													
Pacific Northwest:													
Douglas-fir subregion	25,455	14,611	7,468	7,143	6,829	314	4,542	4,096	446	4,260	3,106	1,154	2,042
Pine subregion	19,910	14,065	9,910	4,155	3,364	791	3,968	3,334	634	1,227	940	287	650
Total	45,365	28,676	17,378	11,298	10,193	1,105	8,510	7,430	1,080	5,487	4,046	1,441	2,692
California	17,317	14,038	11,240	2,798	1,900	898	1,122	625	497	44	15	29	2,113
Northern Rocky Mtn.	33,840	15,039	9,173	5,866	3,560	2,306	11,275	8,494	2,781	4,710	3,632	1,078	2,816
Southern Rocky Mtn.	20,489	12,639	8,239	4,400	2,746	1,654	4,612	3,454	1,158	1,939	1,357	582	1,299
Total	117,011	70,392	46,030	24,362	18,399	5,963	25,519	20,003	5,516	12,180	9,050	3,130	8,920
Continental U. S.	484,340	178,616	46,055	132,561	116,611	15,950	169,408	139,920	29,488	94,709	67,445	27,264	41,607
Coastal Alaska	4,269	4,092	3,954	138	137	1	75	72	3	75	70	5	27
All Regions	488,609	182,708	50,009	132,699	116,748	15,951	169,483	139,992	29,491	94,784	67,515	27,269	41,634

1/ Prepared by Forest Service, U. S. Department of Agriculture.
2/ Because of scattered occurrence and very limited area no estimates, except for eastern South Dakota, have been made of old-growth sawtimber in the North and South.
3/ 40 percent or more stocked.
4/ 10 - 39 percent stocked.

Table 21.--Commercial forest land area in the United States and Coastal Alaska, by major forest type groups and by section and region, January 1, 1953[1]

EASTERN TYPE GROUPS

Section and region	Total, all types	White-red-jack pine	Longleaf-slash pine	Loblolly-shortleaf pine	Spruce-fir	Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Aspen-birch
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
North:											
New England	30,658	3,418	..	165	10,560	49	3,180	..	824	10,558	1,904
Middle Atlantic	42,225	1,649	..	2,772	868	564	18,624	2,716	1,424	10,732	2,876
Lake States	53,272	4,445	..	..	10,016	..	6,443	..	4,609	9,308	18,451
Central	42,394	31	..	580	..	1,722	28,994	1,283	7,638	2,062	84
Plains	5,492	2/442	..	220	..	110	1,333	920	2,333	..	134
Total	174,041	9,985	..	3,737	21,444	2,445	58,574	4,919	16,828	32,660	23,449
South:											
South Atlantic	46,152	208	1,564	16,319	16	5,479	14,919	7,389	..	258	..
Southeast	94,985	106	22,346	22,751	2	8,704	24,104	15,993	448	531	..
West Gulf	52,151	..	2,581	15,698	..	6,261	14,617	11,992	1,002	..	..
Total	193,288	314	26,491	54,768	18	20,444	53,640	35,374	1,450	789	..
Eastern U. S.	367,329	10,299	26,491	58,505	21,462	22,889	112,214	40,293	18,278	33,449	23,449

WESTERN TYPE GROUPS

Section and region	Total, all types	Douglas-fir	Hemlock-Sitka-spruce	Redwood	Ponderosa pine	White pine	Lodgepole pine	Larch	Fir-spruce	Pinon-pine-juniper	Hardwood
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
West:											
Pacific Northwest:											
Douglas-fir subregion	25,455	18,270	3,518	2	678	262	207	..	1,634	..	884
Pine subregion	19,910	1,871	27	..	12,725	329	1,847	1,149	1,808	..	154
Total	45,365	20,141	3,545	2	13,403	591	2,054	1,149	3,442	..	1,038
California	17,317	4,378	6	1,588	6,057	2,255	300	..	2,733	..	..
Northern Rocky Mountain	33,840	6,222	..	..	7,879	2,520	9,649	3,273	2,707	855	735
Southern Rocky Mountain	20,489	990	..	..	10,123	13	2,464	..	4,737	..	2,162
Total	117,011	31,731	3,551	1,590	37,462	5,379	14,467	4,422	13,619	855	3,935
Coastal Alaska	4,269	..	4,263	..	..	..	..	..	..	..	6
Western U. S. and Coastal Alaska	121,280	31,731	7,814	1,590	37,462	5,379	14,467	4,422	13,619	855	3,941

1/ Prepared by Forest Service, U. S. Department of Agriculture.
2/ Ponderosa pine. The total area of ponderosa pine type in the United States is 37,904 thousand acres including 442 thousand acres in the Plains Region.

Table 22.--Commercial forest land area in the United States and Coastal Alaska by ownership class, section and region, and stand-size class, January 1, 1953[1]

Region and stand-size class	All ownerships	Federal ownership or trusteeship: Total	National forest	Indian[2]	Bureau of land management[2]	Other[2]	State[2]	County and municipal[2]	Private
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
NORTH									
New England:									
Sawtimber stands	10,302	492	466	..	..	26	126	50	9,634
Poletimber stands	14,501	278	253	..	..	25	312	120	13,791
Seedling and sapling stands	4,969	114	87	..	..	27	129	79	4,647
Nonstocked and other areas	886	20	16	..	..	4	13	8	845
Total	30,658	904	822	..	..	82	580	257	28,917
Middle Atlantic:									
Sawtimber stands	15,002	532	473	..	..	59	780	62	13,628
Poletimber stands	16,991	582	513	..	..	69	1,797	166	14,446
Seedling and sapling stands	8,842	376	338	..	..	38	925	89	7,452
Nonstocked and other areas	1,390	51	15	..	..	36	143	11	1,185
Total	42,225	1,541	1,339	..	..	202	3,645	328	36,711
Lake States:									
Sawtimber stands	6,457	904	648	205	4	47	461	244	4,848
Poletimber stands	16,010	2,727	2,204	382	19	122	2,304	1,677	9,302
Seedling and sapling stands	20,370	3,022	2,505	293	21	203	3,037	2,919	11,392
Nonstocked and other areas	10,435	887	538	239	23	87	1,945	1,312	6,291
Total	53,272	7,540	5,895	1,119	67	459	7,747	6,152	31,833
Central:									
Sawtimber stands	14,486	1,067	905	(3/)	1	161	204	23	13,192
Poletimber stands	15,722	708	539	1	..	168	207	18	14,789
Seedling and sapling stands	8,957	690	596	(3/)	..	94	87	7	8,173
Nonstocked and other areas	3,229	167	141	(3/)	..	26	11	1	3,050
Total	42,394	2,632	2,181	1	1	449	509	49	39,204
Plains:									
Sawtimber stands	1,475	79	5	60	..	14	17	..	1,379
Poletimber stands	2,289	141	24	97	1	19	30	..	2,118
Seedling and sapling stands	1,053	145	14	106	3	22	12	..	896
Nonstocked and other areas	675	112	2	105	..	5	6	..	557
Total	5,492	477	45	368	4	60	65	(3/)	4,950
Total North:									
Sawtimber stands	47,722	3,074	2,497	265	5	307	1,588	379	42,681
Poletimber stands	65,513	4,436	3,533	480	20	403	4,650	1,981	54,446
Seedling and sapling stands	44,191	4,347	3,540	399	24	384	4,190	3,094	32,560
Nonstocked and other areas	16,615	1,237	712	344	23	158	2,118	1,332	11,928
Total	174,041	13,094	10,282	1,488	72	1,252	12,546	6,786	141,615
SOUTH									
South Atlantic:									
Sawtimber stands	16,833	1,282	1,014	35	..	233	99	33	15,419
Poletimber stands	18,212	1,362	1,173	6	..	183	150	32	16,668
Seedling and sapling stands	9,631	737	543	6	..	188	166	15	8,713
Nonstocked and other areas	1,476	103	53	..	..	50	35	2	1,336
Total	46,152	3,484	2,783	47	..	654	450	82	42,136
Southeast:									
Sawtimber stands	24,505	2,102	1,423	5	8	666	243	214	21,946
Poletimber stands	37,201	2,137	1,530	3	7	597	367	145	34,552
Seedling and sapling stands	21,097	1,028	581	3	4	440	113	105	19,851
Nonstocked and other areas	12,182	970	358	35	9	568	294	71	10,847
Total	94,985	6,237	3,892	46	28	2,271	1,017	535	87,196
West Gulf:									
Sawtimber stands	19,164	1,749	1,498	5	46	200	125	4	17,286
Poletimber stands	22,963	1,986	1,714	10	46	216	158	3	20,816
Seedling and sapling stands	7,610	536	356	8	29	143	96	2	6,976
Nonstocked and other areas	2,414	204	129	1	5	69	11	(3/)	2,199
Total	52,151	4,475	3,697	24	126	628	390	9	47,277
Total South:									
Sawtimber stands	60,502	5,133	3,935	45	54	1,099	467	251	54,651
Poletimber stands	78,376	5,485	4,417	19	53	996	675	180	72,036
Seedling and sapling stands	38,338	2,301	1,480	17	33	771	375	122	35,540
Nonstocked and other areas	16,072	1,277	540	36	14	687	340	73	14,382
Total	193,288	14,196	10,372	117	154	3,553	1,857	626	176,609
WEST									
Pacific Northwest:									
Douglas-fir subregion:									
Sawtimber stands	14,611	7,540	5,680	155	1,684	21	593	148	6,330
Poletimber stands	4,542	895	618	61	208	8	478	135	3,034
Seedling and sapling stands	4,260	772	558	25	164	25	616	123	2,749
Nonstocked and other areas	2,042	500	283	16	200	1	284	46	1,212
Total	25,455	9,707	7,139	257	2,256	55	1,971	452	13,325

Table 22.--Commercial forest land area in the United States and Coastal Alaska by ownership class, section and region, and stand-size class, January 1, 1953[1]--Continued

WEST--Continued

Region and stand-size class	All ownerships	Federal ownership or trusteeship: Total	Federal: National forest	Federal: Indian[2]	Federal: Bureau of land management[2]	Federal: Other[2]	State[2]	County and municipal[2]	Private
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
Pacific Northwest--Continued:									
Pine subregion:									
Sawtimber stands	14,065	9,970	7,672	2,071	218	9	418	37	3,640
Poletimber stands	3,968	2,090	1,595	353	127	15	180	9	1,689
Seedling and sapling stands	1,227	612	495	60	36	21	39	7	569
Nonstocked and other areas	650	271	208	22	23	18	28	..	351
Total	19,910	12,943	9,970	2,506	404	63	665	53	6,249
Total Pacific Northwest:									
Sawtimber stands	28,676	17,510	13,352	2,226	1,902	30	1,011	185	9,970
Poletimber stands	8,510	2,985	2,213	414	335	23	658	144	4,723
Seedling and sapling stands	5,487	1,384	1,053	85	200	46	655	130	3,318
Nonstocked and other areas	2,692	771	491	38	223	19	312	46	1,563
Total	45,365	22,650	17,109	2,763	2,660	118	2,636	505	19,574
California:									
Sawtimber stands	14,038	7,565	7,198	107	231	29	147	6	6,320
Poletimber stands	1,122	486	448	9	28	1	15	(3/)	621
Seedling and sapling stands	44	23	22	(3/)	1	(3/)	(3/)	..	21
Nonstocked and other areas	2,113	996	905	17	64	10	24	2	1,091
Total	17,317	9,070	8,573	133	324	40	186	8	8,053
Northern Rocky Mountain:									
Sawtimber stands	15,039	10,756	9,867	409	469	11	851	14	3,418
Poletimber stands	11,275	8,032	7,237	303	482	10	380	23	2,840
Seedling and sapling stands	4,710	3,364	3,175	83	81	25	197	25	1,124
Nonstocked and other areas	2,816	1,586	1,348	27	174	37	136	17	1,077
Total	33,840	23,738	21,627	822	1,206	83	1,564	79	8,459
Southern Rocky Mountain:									
Sawtimber stands	12,639	11,147	8,830	1,463	834	20	162	8	1,322
Poletimber stands	4,612	2,665	2,403	113	125	24	131	16	1,800
Seedling and sapling stands	1,939	1,426	1,340	13	69	4	51	16	446
Nonstocked and other areas	1,299	888	778	33	69	8	36	3	372
Total	20,489	16,126	13,351	1,622	1,097	56	380	43	3,940
Total West:									
Sawtimber stands	70,392	46,978	39,247	4,205	3,436	30	2,171	213	21,030
Poletimber stands	25,519	14,168	12,301	839	970	58	1,184	183	9,984
Seedling and sapling stands	12,180	6,197	5,590	181	351	75	903	171	4,909
Nonstocked and other areas	8,920	4,241	3,522	115	530	74	508	68	4,103
Total	117,011	71,584	60,660	5,340	5,287	297	4,766	635	40,026
SUMMARY									
Continental United States:									
Sawtimber stands	178,616	55,185	45,679	4,515	3,495	1,496	4,226	843	118,362
Poletimber stands	169,408	24,089	20,251	1,338	1,043	1,457	6,509	2,344	136,466
Seedling and sapling stands	94,709	12,845	10,610	597	408	1,230	5,468	3,387	73,009
Nonstocked and other areas	41,607	6,755	4,774	495	567	919	2,966	1,473	30,413
Total	484,340	98,874	81,314	6,945	5,513	5,102	19,169	8,047	358,250
Coastal Alaska:									
Sawtimber stands	4,092	4,076	3,360	19	697	..	..	..	16
Poletimber stands	75	73	34	1	38	..	..	..	2
Seedling and sapling stands	75	74	34	..	40	..	..	..	1
Nonstocked and other areas	27	27	17	..	10	..	..	..	..
Total	4,269	4,250	3,445	20	785	..	..	..	19
All Regions:									
Sawtimber stands	182,708	59,261	49,039	4,534	4,192	1,496	4,226	843	118,378
Poletimber stands	169,483	24,162	20,285	1,339	1,081	1,457	6,509	2,344	136,468
Seedling and sapling stands	94,784	12,919	10,644	597	448	1,230	5,468	3,387	73,010
Nonstocked and other areas	41,634	6,782	4,791	495	577	919	2,966	1,473	30,413
Total	488,609	103,124	84,759	6,965	6,298	5,102	19,169	8,047	358,269

1/ Prepared by Forest Service, U. S. Department of Agriculture.
2/ Because of different definitions of commercial forest land adopted by the Forest Service and other public agencies, acreage figures for these ownerships may vary from actual published commercial forest land acreages of the public agencies concerned.
3/ Less than 0.5 thousand acres.

Table 23.--Commercial forest land area in private ownership in the United States and Coastal Alaska, by size class, and by section and region, and type of ownership, 1953[1]

NORTH

Section, region, and type of ownership	All classes	Under 100 acres[2]	100 to 500 acres	500 to 5,000 acres	5,000 to 50,000 acres	50,000 acres and larger
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
New England:						
Farm	6,138	2,528	3,157	406	47	..
Lumber manufacturer	1,002	61	198	371	372	..
Pulp manufacturer	6,840	..	..	..	616	6,224
Other wood manufacturer	336	..	..	..	35	301
Other private	14,601	5,311	4,140	804	1,183	3,163
Total	28,917	7,900	7,495	1,581	2,253	9,688
Middle Atlantic:						
Farm	11,800	7,685	3,636	479	..	..
Lumber manufacturer	977	56	228	284	274	135
Pulp manufacturer	889	..	..	..	91	798
Other wood manufacturer	203	3	..	..	128	72
Other private	22,842	10,861	5,503	2,439	2,854	1,185
Total	36,711	18,605	9,367	3,202	3,347	2,190
Lake States:						
Farm	15,184	9,859	4,961	364	..	..
Lumber manufacturer	1,435	36	49	79	396	875
Pulp manufacturer	1,495	..	..	..	230	1,265
Other wood manufacturer	109	..	13	23	13	60
Other private	13,610	5,878	3,907	1,211	1,000	1,614
Total	31,833	15,773	8,930	1,677	1,639	3,814
Central:[3]						
Farm	24,697	16,046	7,465	1,150	36	..
Lumber manufacturer	541	55	65	347	74	..
Other wood manufacturer	276	1	1	..	23	251
Other private	13,690	6,824	3,862	1,984	871	149
Total	39,204	22,926	11,393	3,481	1,004	400
Plains:[3]						
Farm	3,575	2,929	317	229	100	..
Other private	1,375	1,205	106	44	20	..
Total	4,950	4,134	423	273	120	..
Total North:						
Farm	61,394	39,047	19,536	2,628	183	..
Lumber manufacturer	3,955	208	540	1,081	1,116	1,010
Pulp manufacturer	9,224	..	..	..	929	8,295
Other wood manufacturer	924	4	14	23	199	684
Other private	66,118	30,079	17,518	6,482	5,852	6,187
Total	141,615	69,338	37,608	10,214	8,279	16,176
SOUTH						
South Atlantic:						
Farm	29,968	13,388	12,489	3,570	521	..
Lumber manufacturer	2,620	109	583	196	1,142	590
Pulp manufacturer	2,603	..	..	..	98	2,505
Other wood manufacturer	391	..	..	30	278	83
Other private	6,554	1,653	1,810	1,699	944	448
Total	42,136	15,150	14,882	5,495	2,983	3,626
Southeast:						
Farm	45,957	16,698	16,851	9,911	2,497	..
Lumber manufacturer	6,587	96	256	580	3,205	2,450
Pulp manufacturer	6,963	..	..	..	94	6,869
Other wood manufacturer	1,893	..	43	46	1,301	503
Other private	25,796	4,300	7,595	5,605	4,804	3,492
Total	87,196	21,094	24,745	16,142	11,901	13,314
West Gulf:						
Farm	14,218	6,751	5,920	1,384	163	..
Lumber manufacturer	9,310	30	327	215	2,042	6,696
Pulp manufacturer	2,622	..	..	141	..	2,481
Other wood manufacturer	534	19	56	..	311	148
Other private	20,593	5,271	6,519	4,051	2,775	1,977
Total	47,277	12,071	12,822	5,791	5,291	11,302

Table 23.--Commercial forest land area in private ownership in the United States and Coastal Alaska, by size class, and by section and region, and type of ownership, 1953[1/] - Continued

SOUTH - Continued

Section, region, and type of ownership	All classes	Under 100 acres[2/]	100 to 500 acres	500 to 5,000 acres	5,000 to 50,000 acres	50,000 acres and larger
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
Total South:						
Farm	90,143	36,837	35,260	14,865	3,181	..
Lumber manufacturer	18,517	235	1,166	991	6,389	9,736
Pulp manufacturer	12,188	..	..	141	157	11,890
Other wood manufacturer	2,818	19	99	76	1,890	734
Other private	52,943	11,224	15,924	11,355	8,523	5,917
Total	176,609	48,315	52,449	27,428	20,140	28,277
WEST						
Pacific Northwest:						
Farm	5,344	1,217	1,910	2,022	195	..
Lumber manufacturer	6,858	24	122	478	1,614	4,620
Pulp manufacturer	1,681	..	..	6	256	1,419
Other wood manufacturer	341	..	109	19	213	..
Other private	5,350	951	2,075	1,021	587	716
Total	19,574	2,192	4,216	3,546	2,865	6,755
California:						
Farm	1,586	95	331	742	418	..
Lumber manufacturer	3,076	..	52	212	1,368	1,444
Pulp manufacturer	173	..	..	..	..	173
Other wood manufacturer	140	..	3	19	118	..
Other private	3,078	206	636	320	393	1,523
Total	8,053	301	1,022	1,293	2,297	3,140
Northern Rocky Mountain:						
Farm	4,001	427	1,638	1,936	..	..
Lumber manufacturer	2,131	..	21	351	216	1,543
Pulp manufacturer	10	..	..	..	10	..
Other wood manufacturer	190	..	..	..	25	165
Other private	2,127	214	167	323	358	1,065
Total	8,459	641	1,826	2,610	609	2,773
Southern Rocky Mountain:[3/]						
Farm	2,749	158	544	939	557	551
Lumber manufacturer	150	..	4	24	..	122
Other wood manufacturer	6	..	..	..	6	..
Other private	1,035	68	204	324	109	330
Total	3,940	226	752	1,287	672	1,003
Total West:						
Farm	13,680	1,897	4,423	5,639	1,170	551
Lumber manufacturer	12,215	24	199	1,065	3,164	7,763
Pulp manufacturer	1,864	..	..	6	266	1,592
Other wood manufacturer	677	..	112	38	362	165
Other private	11,590	1,439	3,082	1,988	1,438	3,643
Total	40,026	3,360	7,816	8,736	6,400	13,714
SUMMARY						
Continental United States:						
Farm	165,217	77,781	59,219	23,132	4,534	551
Lumber manufacturer	34,687	467	1,905	3,137	10,634	18,544
Pulp manufacturer	23,276	..	..	147	1,278	21,851
Other wood manufacturer	4,419	23	225	137	2,451	1,583
Other private	130,651	42,742	36,524	19,825	15,772	15,788
Total	358,250	121,013	97,873	46,378	34,669	58,317
Coastal Alaska:[3/]						
Other private	19	10	9	..	..	..
All regions:						
Farm	165,217	77,781	59,219	23,132	4,534	551
Lumber manufacturer	34,687	467	1,905	3,137	10,634	18,544
Pulp manufacturer	23,276	..	..	147	1,278	21,851
Other wood manufacturer	4,419	23	225	137	2,451	1,583
Other private	130,670	42,752	36,533	19,825	15,772	15,788
Total	358,269	121,023	97,882	46,378	34,669	58,317

1/ Prepared by Forest Service, U. S. Department of Agriculture. The determination of size class of ownership was based on the total commercial forest land area in the ownership.

2/ Includes ownerships containing 3 to 100 acres of commercial forest land in the East and 10 to 100 acres in the West.

3/ Certain types of ownerships were omitted in these regions because ownership of the omitted types were absent or were so small that total areas by size class would not be adequately determined by sampling procedure.

Table 24.--Commercial forest land area in private ownership in the United States and Coastal Alaska, number of owners, average size of ownerships, and size class of owner by section and region, 1953[1]

Section and region	All classes			Small private holdings												Medium private holdings			Large private holdings		
				Total			Under 100 acres[2]			100 to 500 acres			500 to 5,000 acres			5,000 to 50,000 acres			50,000 acres and larger		
	Area	Owners	Average size holding	Area	Owners	Average size holding	Area	Owners	Average size holding	Area	Owners	Average size holding	Area	Owners	Average size holding	Area	Owners	Average size holding	Area	Owners	Average size holding
	Thousand acres	Number	Acres	Thousand acres	Number	Acres	Thousand acres	Number	Acres	Thousand acres	Number	Acres	Thousand acres	Number	Acres	Thousand acres	Number	Acres	Thousand acres	Number	Acres
North:																					
New England	28,917	254,550	114	16,976	254,378	67	7,900	204,114	39	7,495	48,854	153	1,581	1,410	1,121	2,253	141	15,979	9,688	31	312,516
Middle Atlantic	36,711	764,387	48	31,174	764,124	41	18,605	700,763	27	9,367	59,112	158	3,202	4,249	754	3,347	239	14,004	2,190	24	91,250
Lake States	31,833	491,882	65	26,380	491,774	54	15,773	441,909	36	8,930	47,855	187	1,677	2,010	834	1,639	87	18,839	3,814	21	181,619
Central	39,204	886,071	44	37,800	885,984	43	22,926	814,522	28	11,393	67,233	169	3,481	4,229	823	1,004	83	12,096	400	4	100,000
Plains	4,950	157,043	32	4,830	157,023	31	4,134	154,781	27	423	1,881	225	273	361	756	120	20	6,000	..	..	..
Total	141,615	2,553,921	55	117,160	2,553,283	46	69,338	2,316,089	30	37,608	224,935	167	10,214	12,259	833	8,279	563	14,705	16,176	75	215,680
South:																					
South Atlantic	42,136	594,432	71	35,527	594,165	60	15,150	497,356	30	14,882	90,688	164	5,495	6,121	898	2,983	244	12,225	3,626	23	157,652
Southeast	87,196	778,529	112	61,981	777,620	80	21,094	613,531	34	24,745	149,917	165	16,142	14,172	1,139	11,901	827	14,390	13,314	82	162,366
West Gulf	47,277	454,077	104	30,684	453,712	68	12,071	365,591	33	12,822	81,809	157	5,791	6,312	917	5,291	308	17,179	11,302	57	198,281
Total	176,609	1,827,020	97	128,192	1,825,497	70	48,315	1,476,478	33	52,449	322,414	163	27,428	26,605	1,031	20,140	1,367	14,733	28,277	156	181,263
West:																					
Pacific Northwest:																					
D.-fir subregion	13,325	67,983	196	6,117	67,827	90	1,859	52,782	35	2,534	13,350	190	1,724	1,695	1,017	2,199	133	16,534	5,009	23	217,783
Pine subregion	6,249	15,937	392	3,837	15,869	242	333	7,059	47	1,682	7,470	225	1,822	1,340	1,360	791	58	13,638	1,621	10	162,100
Total	19,574	83,192	233	9,954	83,696	119	2,192	59,841	37	4,216	20,820	202	3,546	3,035	1,168	2,865	186	15,403	6,755	30	225,167
California	8,053	10,464	770	2,616	10,307	254	301	5,337	56	1,022	3,971	257	1,293	999	1,294	2,297	141	16,291	3,140	16	196,250
Northern Rocky Mtn.	8,459	27,176	311	5,077	27,130	187	641	13,965	46	1,826	10,886	168	2,610	2,279	1,145	609	37	16,459	2,773	9	308,111
Southern Rocky Mtn.	3,940	7,754	508	2,265	7,687	295	226	3,137	72	752	3,401	221	1,287	1,149	1,120	672	56	12,000	1,003	11	91,182
Total	40,026	129,291	310	19,912	128,820	154	3,360	82,280	41	7,816	39,078	200	8,736	7,462	1,171	6,400	409	15,648	13,714	62	221,194
Continental U. S.	358,250	4,510,213	79	265,264	4,507,600	59	121,013	3,874,847	31	97,873	586,427	167	46,378	46,326	1,001	34,669	2,330	14,879	58,317	283	206,067
Coastal Alaska	19	286	66	19	286	66	10	246	41	9	40	225	..	..	..	..	..	..	..	..	..
All regions	358,269	4,510,499	79	265,283	4,507,886	59	121,023	3,875,093	31	97,882	586,467	167	46,378	46,326	1,001	34,669	2,330	14,879	58,317	283	206,067

1/ Prepared by Forest Service, U. S. Department of Agriculture. Because some owners have various size holdings in one or more regions the determination of size class of private ownership and area owned was based on the total commercial forest land area in the ownership, and number of owners on the total number within each ownership class, whether for a region, section, or for the country as a whole. Thus, except for small ownerships, regional totals do not add to sectional totals that give the proper ownership distribution on a sectional basis, nor do sectional totals add to national totals which show the correct ownership distribution for the entire country. Data were lacking on which to adjust for possible duplication of ownerships in the small ownership classes when considered strictly on a sectional or national basis. Such duplication that may exist in small ownerships is however believed to affect relatively less area and fewer owners than in the medium and large classes.

2/ Includes ownerships containing 3 to 100 acres of commercial forest land in the East and 10 to 100 acres in the West.

Table 25.--Net volume of live sawtimber on commercial forest land in the United States and Coastal Alaska by ownership class, section and region, and by softwoods and hardwoods, January 1, 1953[1/]

NORTH

Region and species group	All ownerships	Federal ownership or trusteeship: Total	National forest	Indian[2/]	Bureau of land management[2/]	Other[2/]	State[2/]	County and municipal[2/]	Private: Total	Farm	Industrial and other
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
New England:											
Softwood	27,169	1,245	1,177	..	..	68	283	167	25,474	6,425	19,049
Hardwood	24,356	1,187	1,133	..	..	54	394	165	22,610	6,039	16,571
Total	51,525	2,432	2,310	..	..	122	677	332	48,084	12,464	35,620
Middle Atlantic:											
Softwood	13,328	228	172	..	..	56	969	67	12,064	3,481	8,583
Hardwood	61,023	1,729	1,519	..	..	210	4,085	276	54,933	15,291	39,642
Total	74,351	1,957	1,691	..	..	266	5,054	343	66,997	18,772	48,225
Lake States:											
Softwood	14,355	3,955	2,743	1,075	23	114	1,975	1,068	7,357	2,053	5,304
Hardwood	35,435	4,235	2,909	1,070	12	244	2,393	1,593	27,214	15,008	12,206
Total	49,790	8,190	5,652	2,145	35	358	4,368	2,661	34,571	17,061	17,510
Central:											
Softwood	3,420	247	200	..	..	47	30	3	3,140	1,637	1,503
Hardwood	79,251	4,118	3,241	2	1	874	884	126	74,123	47,136	26,987
Total	82,671	4,365	3,441	2	1	921	914	129	77,263	48,773	28,490
Plains:											
Softwood	670	108	13	95	..	..	10	2	550	389	161
Hardwood	7,007	315	..	221	1	93	20	10	6,662	4,813	1,849
Total	7,677	423	13	316	1	93	30	12	7,212	5,202	2,010
Total North:											
Softwood	58,942	5,783	4,305	1,170	23	285	3,267	1,307	48,585	13,985	34,600
Hardwood	207,072	11,584	8,802	1,293	14	1,475	7,776	2,170	185,542	88,287	97,255
Total	266,014	17,367	13,107	2,463	37	1,760	11,043	3,477	234,127	102,272	131,855
SOUTH											
South Atlantic:											
Softwood	51,144	3,163	2,140	20	..	1,003	571	77	47,333	31,627	15,706
Hardwood	55,714	4,642	4,118	60	..	464	346	101	50,625	34,191	16,434
Total	106,858	7,805	6,258	80	..	1,467	917	178	97,958	65,818	32,140
Southeast:											
Softwood	76,833	7,957	5,266	19	23	2,649	717	242	67,917	29,635	38,282
Hardwood	62,469	4,623	2,944	14	13	1,652	612	726	56,508	28,719	27,789
Total	139,302	12,580	8,210	33	36	4,301	1,329	968	124,425	58,354	66,071
West Gulf:											
Softwood	54,956	6,516	6,182	7	54	273	228	6	48,206	5,920	42,286
Hardwood	55,952	3,486	2,566	17	173	730	563	13	51,890	13,722	38,168
Total	110,908	10,002	8,748	24	227	1,003	791	19	100,096	19,642	80,454
Total South:											
Softwood	182,933	17,636	13,588	46	77	3,925	1,516	325	163,456	67,182	96,274
Hardwood	174,135	12,751	9,628	91	186	2,846	1,521	840	159,023	76,632	82,391
Total	357,068	30,387	23,216	137	263	6,771	3,037	1,165	322,479	143,814	178,665
WEST											
Pacific Northwest:											
Douglas-fir subregion:											
Softwood	577,116	284,344	218,791	6,474	58,199	880	27,398	6,348	259,026	12,537	246,489
Hardwood	17,259	4,059	2,867	285	907	..	1,155	199	11,846	566	11,280
Total	594,375	288,403	221,658	6,759	59,106	880	28,553	6,547	270,872	13,103	257,769
Pine subregion:											
Softwood	154,317	110,557	87,165	20,943	2,356	93	4,291	361	39,108	2,752	36,356
Hardwood	184	122	84	35	3	..	9	..	53	3	50
Total	154,501	110,679	87,249	20,978	2,359	93	4,300	361	39,161	2,755	36,406
Total Pacific Northwest:											
Softwood	731,433	394,901	305,956	27,417	60,555	973	31,689	6,709	298,134	15,289	282,845
Hardwood	17,443	4,181	2,951	320	910	..	1,164	199	11,899	569	11,330
Total	748,876	399,082	308,907	27,737	61,465	973	32,853	6,908	310,033	15,858	294,175
California:											
Softwood	354,024	186,482	176,595	3,863	5,665	359	4,442	189	162,911	30,403	132,508
Hardwood	5,977	2,587	2,318	106	152	11	105	6	3,279	976	2,303
Total	360,001	189,069	178,913	3,969	5,817	370	4,547	195	166,190	31,379	134,811

Table 25.--Net volume of live sawtimber on commercial forest land in the United States and Coastal Alaska by ownership class, section and region, and by softwoods and hardwoods, January 1, 1953[1/]--Continued

WEST--Continued

Region and species group	All ownerships	Federal ownership or trusteeship: Total	National forest	Indian 2/	Bureau of land management 2/	Other 2/	State 2/	County and municipal 2/	Private: Total	Farm	Industrial and other
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Northern Rocky Mountain:											
Softwood	165,682	114,877	108,167	2,771	3,890	49	11,805	121	38,879	9,501	29,378
Hardwood	1,340	468	65	380	23	..	27	2	843	427	416
Total	167,022	115,345	108,232	3,151	3,913	49	11,832	123	39,722	9,928	29,794
Southern Rocky Mountain:											
Softwood	65,589	58,299	48,424	7,373	2,412	90	765	39	6,486	3,756	2,730
Hardwood	3,219	2,211	2,052	76	65	18	67	1	940	796	144
Total	68,808	60,510	50,476	7,449	2,477	108	832	40	7,426	4,552	2,874
Total West:											
Softwood	1,316,728	754,559	639,142	41,424	72,522	1,471	48,701	7,058	506,410	58,949	447,461
Hardwood	27,979	9,447	7,386	882	1,150	29	1,363	208	16,961	2,768	14,193
Total	1,344,707	764,006	646,528	42,306	73,672	1,500	50,064	7,266	523,371	61,717	461,654
SUMMARY											
Continental United States:											
Softwood	1,558,603	777,978	657,035	42,640	72,622	5,681	53,484	8,690	718,451	140,116	578,335
Hardwood	409,186	33,782	25,816	2,266	1,350	4,350	10,660	3,218	361,526	167,687	193,839
Total	1,967,789	811,760	682,851	44,906	73,972	10,031	64,144	11,908	1,079,977	307,803	772,174
Coastal Alaska:											
Softwood	88,951	88,629	82,481	61	6,087	..	..	..	322	..	322
Hardwood	107	107	43	..	64	..	..	..	(3/)	..	(3/)
Total	89,058	88,736	82,524	61	6,151	..	..	..	322	..	322
All Regions:											
Softwood	1,647,554	866,607	739,516	42,701	78,709	5,681	53,484	8,690	718,773	140,116	578,657
Hardwood	409,293	33,889	25,859	2,266	1,414	4,350	10,660	3,218	361,526	167,687	193,839
Total	2,056,847	900,496	765,375	44,967	80,123	10,031	64,144	11,908	1,080,299	307,803	772,496

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net volume in board feet log scale, International 1/4-inch rule.

2/ Because of different definitions of commercial forest land, different cruising standards, specifications, and log rules adopted by the Forest Service and other public agencies, volume estimates for these ownerships may vary from actual published figures of the public agencies concerned.

3/ Less than 0.5 million board feet.

Table 26.--Net volume of live sawtimber on commercial forest land in Eastern United States by species group, and by section and region, January 1, 1953 1/

(Comparable to regional totals of Table 10, Basic Forest Statistics for the United States January 1945, revised September 1950)

Species group	Total Eastern U. S.	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Softwoods:											
White and red pine	17,330	16,262	7,602	3,577	5,015	68	..	1,068	737	331	..
Jack pine	2,104	2,104	1	20	2,083	..	..	..	..	..	..
Longleaf and slash pine	36,638	..	..	..	..	..	..	36,638	3,184	31,083	2,371
Shortleaf and loblolly pine	124,744	3,992	..	1,725	..	1,897	370	120,752	36,968	35,078	48,706
Other pines	12,251	2,176	41	1,555	..	580	..	10,075	6,148	3,625	302
Spruce and balsam fir	19,084	19,074	14,440	1,937	2,697	..	..	10	10	..	..
Hemlock	12,333	10,928	3,749	4,012	2,735	432	..	1,405	1,113	292	..
Cypress	12,682	280	..	..	..	280	3/ (2/)	12,402	2,761	6,097	3,544
Other	4,709	4,126	1,336	502	1,825	163	3/ 300	583	223	327	33
Total	241,875	58,942	27,169	13,328	14,355	3,420	3/ 670	182,933	51,144	76,833	54,956
Hardwoods:											
White oak 4/	35,432	20,552	423	6,863	1,965	11,294	7	14,880	5,664	5,125	4,091
Other white oak	27,342	10,844	39	2,126	784	7,423	472	16,498	5,325	4,731	6,442
Red oak 5/	31,023	23,554	1,709	10,178	5,600	5,894	173	7,469	2,576	2,553	2,340
Other red oak	52,592	19,872	347	3,166	1,145	14,565	649	32,720	8,630	12,536	11,554
Yellow birch	11,701	11,647	5,824	3,924	1,890	9	..	54	25	11	18
Sugar maple	22,929	22,517	6,315	7,289	6,080	2,833	..	412	141	217	54
Soft maple	13,913	10,195	1,098	4,304	2,047	2,704	42	3,718	2,183	1,088	447
Beech	15,888	13,147	2,055	6,174	1,068	3,850	..	2,741	772	1,211	758
Sweetgum	25,750	1,953	..	883	..	910	160	23,797	6,927	8,299	8,571
Tupelo and blackgum	24,563	1,756	3	654	..	1,017	82	22,807	8,874	8,373	5,560
Ash	11,027	6,297	355	1,655	1,425	2,477	385	4,730	1,334	1,307	2,089
Hickory	23,896	9,032	93	2,046	150	6,688	55	14,864	3,535	6,111	5,218
Cottonwood and aspen	9,376	7,914	348	309	3,958	1,617	1,682	1,462	88	558	816
Basswood	6,763	6,298	112	2,026	2,759	1,271	130	465	192	235	38
Yellow-poplar	16,370	6,791	107	3,035	..	3,649	..	9,579	5,675	3,845	59
Black walnut	2,109	1,687	..	83	27	1,408	169	422	162	206	54
Other	50,533	33,016	5,528	6,308	6,537	11,642	3,001	17,517	3,611	6,063	7,843
Total	381,207	207,072	24,356	61,023	35,435	79,251	7,007	174,135	55,714	62,469	55,952
All species	623,082	266,014	51,525	74,351	49,790	82,671	7,677	357,068	106,858	139,302	110,908

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net volume in board feet log scale, International 1/4-inch rule.
2/ Less than 0.5 million board feet.
3/ Includes 294 million board feet of ponderosa pine. The total volume of ponderosa and Jeffrey pine in the United States is 224,503 million board feet including 294 million board feet in the Plains Region.
4/ *Quercus alba* and *Q. prinus*.
5/ *Quercus borealis*, *Q. falcata* var. *pagodaefolia* and *Q. shumardii*.

Table 27.--Net volume of live sawtimber on commercial forest land in Western United States and Coastal Alaska by species group, and by section and region, January 1, 1953 1/

(Comparable to Table 10, Basic Forest Statistics for the United States January 1945, revised September 1950)

Species group	Total Western U. S. and Coastal Alaska	West: Total	Pacific Northwest: Total	Pacific Northwest: Douglas-fir subregion	Pacific Northwest: Pine subregion	California	Northern Rocky Mountain	Southern Rocky Mountain	Coastal Alaska
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Softwoods:									
Douglas-fir	531,868	531,868	365,912	337,251	28,661	116,912	43,220	5,824	..
Ponderosa and Jeffrey pine	2/ 224,209	2/ 224,209	92,232	5,900	86,332	66,741	33,061	32,175	..
True firs	183,705	183,705	73,508	58,428	15,080	88,717	16,983	4,497	..
Western hemlock	171,895	117,497	114,735	112,065	2,670	478	2,284	..	54,398
Sugar pine	35,121	35,121	7,737	7,418	319	27,384	..	..	..
Western white pine	21,383	21,383	4,771	3,244	1,527	2,131	14,474	7	..
Redwood	36,214	36,214	90	90	..	36,124	..	..	..
Sitka spruce	35,888	9,293	9,123	9,123	..	170	..	..	26,595
Engelmann and other spruces	37,135	36,962	3,371	410	2,961	..	17,737	15,854	173
Western larch	28,019	28,019	10,348	210	10,138	..	17,671	..	..
Western redcedar	36,295	31,654	28,198	27,575	623	2	3,454	..	4,641
California incense-cedar	13,296	13,296	3,557	3,321	236	9,727	..	12	..
Lodgepole pine	30,126	30,051	3,553	334	3,219	3,807	15,891	6,800	75
Other	20,525	17,456	14,298	11,747	2,551	1,831	907	420	3,069
Total	1,405,679	1,316,728	731,433	577,116	154,317	354,024	165,682	65,589	88,951
Hardwoods:									
Cottonwood and aspen	3,742	3,742	123	..	123	37	463	3,119	..
Red alder	9,414	9,414	9,245	9,245	..	166	..	3	..
Other	14,930	14,823	8,075	8,014	61	5,774	877	97	107
Total	28,086	27,979	17,443	17,259	184	5,977	1,340	3,219	107
All species	1,433,765	1,344,707	748,876	594,375	154,501	360,001	167,022	68,808	89,058

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net volume in board feet log scale, International 1/4-inch rule.
2/ Excludes 294 million board feet of ponderosa pine in the Plains Region. The total volume of ponderosa and Jeffrey pine in the United States is 224,503 million board feet.

Table 28.--Net volume of live sawtimber on commercial forest land in Eastern United States by section and region, and species group and diameter class January 1, 1953 1/

SOFTWOODS

Species group and d.b.h. class (inches)	Total East	North: Total	North: New England	North: Middle Atlantic	North: Lake States	Central	Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Southern yellow pine:											
9.0 - 10.9	41,893	1,654	14	854	..	693	93	40,239	10,613	20,001	9,625
11.0 - 14.9	77,297	3,133	18	1,659	..	1,271	185	74,164	19,877	31,995	22,292
15.0 - 18.9	37,528	1,084	9	629	..	372	74	36,444	10,264	12,493	13,687
19.0 and larger	16,915	297	..	138	..	141	18	16,618	5,546	5,297	5,775
Total	173,633	6,168	41	3,280	..	2,477	370	167,465	46,300	69,786	51,379
White and red pine:											
9.0 - 10.9	2,947	2,834	1,431	553	850	..	..	113	74	39	..
11.0 - 14.9	6,236	5,901	2,697	1,306	1,896	2	..	335	240	95	..
15.0 - 18.9	4,347	4,010	1,869	972	1,150	19	..	337	243	94	..
19.0 and larger	3,800	3,517	1,605	746	1,119	47	..	283	180	103	..
Total	17,330	16,262	7,602	3,577	5,015	68	..	1,068	737	331	..
Other softwoods:											
9.0 - 10.9	12,088	9,741	4,873	1,322	3,380	114	52	2,347	423	1,586	338
11.0 - 14.9	19,752	14,497	7,808	2,607	3,664	238	180	5,255	1,230	2,870	1,155
15.0 - 18.9	9,862	6,758	3,890	1,459	1,147	219	43	3,104	908	1,018	1,178
19.0 and larger	9,210	5,516	2,955	1,083	1,149	304	25	3,694	1,546	1,242	906
Total	50,912	36,512	19,526	6,471	9,340	875	2/ 300	14,400	4,107	6,716	3,577
All softwoods:											
9.0 - 10.9	56,928	14,229	6,318	2,729	4,230	807	145	42,699	11,110	21,626	9,963
11.0 - 14.9	103,285	23,531	10,523	5,572	5,560	1,511	365	79,754	21,347	34,960	23,447
15.0 - 18.9	51,737	11,852	5,768	3,060	2,297	610	117	39,885	11,415	13,605	14,865
19.0 and larger	29,925	9,330	4,560	1,967	2,268	492	43	20,595	7,272	6,642	6,681
Total	241,875	58,942	27,169	13,328	14,355	3,420	2/ 670	182,933	51,144	76,833	54,956

HARDWOODS

Species group and d.b.h. class (inches)	Total East	North: Total	North: New England	North: Middle Atlantic	North: Lake States	Central	Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
White oaks:											
11.0 - 14.9	27,491	14,153	307	4,046	1,675	7,874	251	13,338	5,009	4,159	4,170
15.0 - 18.9	17,380	8,694	89	2,529	722	5,237	117	8,686	2,741	2,704	3,241
19.0 and larger	17,903	8,549	66	2,414	352	5,606	111	9,354	3,239	2,993	3,122
Total	62,774	31,396	462	8,989	2,749	18,717	479	31,378	10,989	9,856	10,533
Red oaks:											
11.0 - 14.9	33,347	17,900	1,081	5,352	4,066	7,214	187	15,447	4,654	5,713	5,080
15.0 - 18.9	24,826	12,997	585	4,047	1,822	6,282	261	11,829	3,118	4,547	4,164
19.0 and larger	25,442	12,529	390	3,945	857	6,963	374	12,913	3,434	4,829	4,650
Total	83,615	43,426	2,056	13,344	6,745	20,459	822	40,189	11,206	15,089	13,894
Sweetgum, tupelo, and blackgum:											
11.0 - 14.9	22,651	1,484	3	622	..	756	103	21,167	7,275	8,127	5,765
15.0 - 18.9	16,858	1,282	..	578	..	614	90	15,576	5,334	5,272	4,970
19.0 and larger	10,804	943	..	337	..	557	49	9,861	3,192	3,273	3,396
Total	50,313	3,709	3	1,537	..	1,927	242	46,604	15,801	16,672	14,131
Yellow-poplar:											
11.0 - 14.9	6,482	2,510	42	1,191	..	1,277	..	3,972	2,380	1,569	23
15.0 - 18.9	5,380	2,218	29	929	..	1,260	..	3,162	1,768	1,375	19
19.0 and larger	4,508	2,063	36	915	..	1,112	..	2,445	1,527	901	17
Total	16,370	6,791	107	3,035	..	3,649	..	9,579	5,675	3,845	59
Yellow birch:											
11.0 - 14.9	4,104	4,091	2,298	1,052	734	7	..	13	5	4	4
15.0 - 18.9	3,188	3,167	1,647	972	546	2	..	21	6	5	10
19.0 and larger	4,409	4,389	1,879	1,900	610	..	..	20	14	2	4
Total	11,701	11,647	5,824	3,924	1,890	9	..	54	25	11	18
Sugar maple:											
11.0 - 14.9	8,811	8,680	2,608	2,462	2,658	952	..	131	13	95	23
15.0 - 18.9	7,005	6,898	1,930	2,211	1,961	796	..	107	28	61	18
19.0 and larger	7,113	6,939	1,777	2,616	1,461	1,085	..	174	100	61	13
Total	22,929	22,517	6,315	7,289	6,080	2,833	..	412	141	217	54
Beech:											
11.0 - 14.9	5,415	4,705	985	2,338	644	738	..	710	276	228	206
15.0 - 18.9	5,173	4,303	751	2,128	308	1,116	..	870	210	374	286
19.0 and larger	5,300	4,139	319	1,708	116	1,996	..	1,161	286	609	266
Total	15,888	13,147	2,055	6,174	1,068	3,850	..	2,741	772	1,211	758
Other hardwoods:											
11.0 - 14.9	52,685	34,269	3,865	7,972	10,095	10,759	1,578	18,416	5,004	7,085	6,327
15.0 - 18.9	33,793	20,324	2,149	4,765	3,943	7,875	1,592	13,469	3,138	4,858	5,473
19.0 and larger	31,139	19,846	1,520	3,994	2,865	9,173	2,294	11,293	2,963	3,625	4,705
Total	117,617	74,439	7,534	16,731	16,903	27,807	5,464	43,178	11,105	15,568	16,505
All hardwoods:											
11.0 - 14.9	160,986	87,792	11,189	25,035	19,872	29,577	2,119	73,194	24,616	26,980	21,598
15.0 - 18.9	113,603	59,883	7,180	18,159	9,302	23,182	2,060	53,720	16,343	19,196	18,181
19.0 and larger	106,618	59,397	5,987	17,829	6,261	26,492	2,828	47,221	14,755	16,293	16,173
Total	381,207	207,072	24,356	61,023	35,435	79,251	7,007	174,135	55,714	62,469	55,952

ALL SPECIES

Species group and d.b.h. class (inches)	Total East	North: Total	North: New England	North: Middle Atlantic	North: Lake States	Central	Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
All species:											
9.0 - 10.9	56,928	14,229	6,318	2,729	4,230	807	145	42,699	11,110	21,626	9,963
11.0 - 14.9	264,271	111,323	21,712	30,607	25,432	31,088	2,484	152,948	45,963	61,940	45,045
15.0 - 18.9	165,340	71,735	12,948	21,219	11,599	23,792	2,177	93,605	27,758	32,801	33,046
19.0 and larger	136,543	68,727	10,547	19,796	8,529	26,984	2,871	67,816	22,027	22,935	22,854
Total	623,082	266,014	51,525	74,351	49,790	82,671	7,677	357,068	106,858	139,302	110,908

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net volume in board feet log scale, International 1/4-inch rule.

2/ Includes 294 million board feet of ponderosa pine consisting of 226 million board feet 9.0 - 14.9 inches d.b.h. and 68 million board feet 15.0 inches and larger. The total volume of ponderosa and Jeffrey pine in the United States is 224,503 million board feet including 294 million board feet in the Plains Region.

Table 29.--Net volume of live softwood sawtimber on commercial forest land in Western United States and Coastal Alaska, by species group and diameter class, and by section and region, January 1, 1953[1/]

Species group and d.b.h. class (inches)	Total Western U. S. and Coastal Alaska	West: Total West	West: Pacific Northwest: Total	West: Pacific Northwest: Douglas-fir subregion	West: Pacific Northwest: Pine subregion	West: California	West: Northern Rocky Mountain	West: Southern Rocky Mountain	Coastal Alaska
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Ponderosa and Jeffrey pine:									
11.0 - 20.9	45,438	45,438	15,983	471	15,512	7,533	10,970	10,952	..
21.0 - 30.9	81,323	81,323	36,970	1,530	35,440	17,136	12,387	14,830	..
31.0 and larger	97,448	97,448	39,279	3,899	35,380	42,072	9,704	6,393	..
Total	224,209	2/224,209	92,232	5,900	86,332	66,741	33,061	32,175	..
Sugar and western white pine:									
11.0 - 20.9	11,725	11,725	2,217	1,273	944	1,956	7,550	2	..
21.0 - 30.9	11,594	11,594	2,219	1,499	720	4,669	4,704	2	..
31.0 and larger	33,185	33,185	8,072	7,890	182	22,890	2,220	3	..
Total	56,504	56,504	12,508	10,662	1,846	29,515	14,474	7	..
Douglas-fir:									
11.0 - 20.9	94,120	94,120	59,939	50,907	9,032	9,171	22,862	2,148	..
21.0 - 30.9	122,268	122,268	81,804	70,865	10,939	23,033	15,253	2,178	..
31.0 and larger	315,480	315,480	224,169	215,479	8,690	84,708	5,105	1,498	..
Total	531,868	531,868	365,912	337,251	28,661	116,912	43,220	5,824	..
Redwood:									
11.0 - 20.9	3,363	3,363	5	5	..	3,358	..	..	..
21.0 - 30.9	4,499	4,499	9	9	..	4,490	..	..	..
31.0 and larger	28,352	28,352	76	76	..	28,276	..	..	..
Total	36,214	36,214	90	90	..	36,124	..	..	..
Other softwoods:									
11.0 - 20.9	164,199	133,066	54,566	35,894	18,672	15,867	45,643	16,990	31,133
21.0 - 30.9	167,714	139,250	79,330	65,452	13,878	30,188	22,135	7,597	28,464
31.0 and larger	224,971	195,617	126,795	121,867	4,928	58,677	7,149	2,996	29,354
Total	556,884	467,933	260,691	223,213	37,478	104,732	74,927	27,583	88,951
All softwoods:									
11.0 - 20.9	318,845	287,712	132,710	88,550	44,160	37,885	87,025	30,092	31,133
21.0 - 30.9	387,398	358,934	200,332	139,355	60,977	79,516	54,479	24,607	28,464
31.0 and larger	699,436	670,082	398,391	349,211	49,180	236,623	24,178	10,890	29,354
Total	1,405,679	1,316,728	731,433	577,116	154,317	354,024	165,682	65,589	88,951

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net volume in board feet log scale, International 1/4-inch rule.
2/ Excludes 294 million board feet of ponderosa pine in the Plains Region. The total volume of ponderosa and Jeffrey pine in the United States is 224,503 million board feet.

Table 30.--Net volume of growing stock on commercial forest land in Eastern United States by section and region, and species group and diameter class January 1, 1953[1]

SOFTWOODS

Species group and d.b.h. class (inches)	Total East	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords
White and red pines:											
5.0 - 6.9	5.0	4.4	2.0	1.0	1.4	(3/)	..	0.6	0.5	0.1	..
7.0 - 8.9	11.4	11.0	6.0	3.0	2.0	(3/)	..	.4	.2	.2	..
9.0 - 10.9	12.1	11.6	7.0	2.0	2.6	..	..	.5	.3	.2	..
11.0 and larger	38.7	36.9	17.0	9.0	10.7	0.2	..	1.8	1.2	.6	..
Total	67.2	63.9	32.0	15.0	16.7	.2	..	3.3	2.2	1.1	..
Jack pine:											
5.0 - 6.9	4.9	4.9	..	..	4.9	..	..	..	..	..	..
7.0 - 8.9	5.2	5.2	..	..	5.2	..	..	..	..	..	..
9.0 - 10.9	3.2	3.2	..	..	3.2	..	..	..	..	..	..
11.0 and larger	2.9	2.9	..	..	2.9	..	..	..	..	..	..
Total	16.2	16.2	..	..	16.2	..	..	..	..	..	..
Southern yellow pines:											
5.0 - 6.9	86.9	4.9	(2/)	3.0	..	1.8	0.1	82.0	27.0	42.1	12.9
7.0 - 8.9	131.7	7.2	(2/)	4.0	..	3.1	.1	124.5	40.1	62.9	21.5
9.0 - 10.9	127.6	7.5	(2/)	5.0	..	2.2	.3	120.1	33.3	60.3	26.5
11.0 and larger	321.6	12.3	1.0	6.0	..	4.7	.6	309.3	87.1	124.3	97.9
Total	667.8	31.9	1.0	18.0	..	11.8	1.1	635.9	187.5	289.6	158.8
Spruce and balsam fir:											
5.0 - 6.9	22.7	22.6	11.0	1.0	10.6	..	..	.1	.1	..	..
7.0 - 8.9	23.2	23.1	14.0	1.0	8.1	..	..	.1	.1	..	..
9.0 - 10.9	17.4	17.4	11.0	2.0	4.4	..	..	..	..	..	..
11.0 and larger	41.4	41.4	32.0	6.0	3.4	..	..	..	..	..	..
Total	104.7	104.5	68.0	10.0	26.5	..	..	.2	.2	..	..
Hemlock:											
5.0 - 6.9	5.5	5.4	2.0	3.0	.4	(3/)	..	.1	.1	..	..
7.0 - 8.9	8.2	7.9	3.0	4.0	.8	.1	..	.3	.2	.1	..
9.0 - 10.9	7.4	7.1	3.0	3.0	1.0	.1	..	.3	.2	.1	..
11.0 and larger	26.3	23.8	8.0	9.0	6.1	.7	..	2.5	2.0	.5	..
Total	47.4	44.2	16.0	19.0	8.3	.9	..	3.2	2.5	.7	..
Cypress:											
5.0 - 6.9	6.2	..	..	..	..	(3/)	(3/)	6.2	.9	4.9	.4
7.0 - 8.9	8.2	..	..	..	..	(3/)	(3/)	8.2	1.3	6.0	.9
9.0 - 10.9	6.3	..	..	..	..	(3/)	(3/)	6.3	.8	4.5	1.0
11.0 and larger	26.5	.9	..	..	..	.9	(3/)	25.6	6.1	11.6	7.9
Total	47.2	.9	..	..	..	.9	(3/)	46.3	9.1	27.0	10.2
Other softwoods:											
5.0 - 6.9	9.9	8.6	2.0	1.0	4.6	.8	.2	1.3	.6	.6	.1
7.0 - 8.9	8.6	7.4	1.0	1.0	4.5	.6	.3	1.2	.6	.5	.1
9.0 - 10.9	4.3	3.7	1.0	..	2.2	.4	.1	.6	.3	.3	(2/)
11.0 and larger	11.9	11.0	3.0	4.0	2.8	.7	.5	.9	.2	.7	(2/)
Total	34.7	30.7	7.0	6.0	14.1	2.5	[4] 1.1	4.0	1.7	2.1	.2
All softwoods:											
5.0 - 6.9	141.1	50.8	17.0	9.0	21.9	2.6	.3	90.3	29.2	47.7	13.4
7.0 - 8.9	196.5	61.8	24.0	13.0	20.6	3.8	.4	134.7	42.5	69.7	22.5
9.0 - 10.9	178.3	50.5	22.0	12.0	13.4	2.7	.4	127.8	34.9	65.4	27.5
11.0 and larger	469.3	129.2	61.0	34.0	25.9	7.2	1.1	340.1	96.6	137.7	105.8
Total	985.2	292.3	124.0	68.0	81.8	16.3	2.2	692.9	203.2	320.5	169.2

HARDWOODS

Species group and d.b.h. class (inches)	Total East	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
Oak:											
5.0 - 6.9	77.9	42.5	2.0	19.0	6.1	14.3	1.1	35.4	10.5	13.9	11.0
7.0 - 8.9	108.2	59.2	4.0	23.0	7.7	23.4	1.1	49.0	15.3	19.5	14.2
9.0 - 10.9	131.0	67.6	4.0	24.0	8.4	29.7	1.5	63.4	19.[illegible]	24.9	13.6
11.0 and larger	433.4	217.1	9.0	68.0	25.0	111.0	4.1	216.3	54.9	78.5	82.9
Total	750.5	386.4	19.0	134.0	47.2	178.4	7.8	364.1	100.6	136.8	126.7
Beech-yellow birch-hard maple:											
5.0 - 6.9	30.6	29.7	11.0	13.0	4.1	1.6	..	.9	.4	.3	.2
7.0 - 8.9	39.9	38.5	16.0	15.0	5.3	2.2	..	1.4	.6	.5	.3
9.0 - 10.9	43.7	41.6	16.0	17.0	5.8	2.8	..	2.1	.9	.8	.4
11.0 and larger	128.4	118.7	36.0	41.0	24.1	17.6	..	9.7	2.4	4.7	2.6
Total	242.6	228.5	79.0	86.0	39.3	24.2	..	14.1	4.3	6.3	3.5
Hickory:											
5.0 - 6.9	15.4	6.9	..	2.0	.2	4.6	.1	8.5	2.0	4.1	2.4
7.0 - 8.9	20.8	9.5	..	2.0	.3	7.1	.1	11.3	2.4	5.7	3.2
9.0 - 10.9	24.0	9.8	..	2.0	.2	7.5	.1	14.2	3.6	6.3	4.3
11.0 and larger	73.3	27.0	1.0	7.0	.4	18.5	.1	46.3	9.2	19.6	17.5
Total	133.5	53.2	1.0	13.0	1.1	37.7	.4	80.3	17.2	35.7	27.4

Table 30.--Net volume of growing stock on commercial forest land in Eastern United States by section and region, and species group and diameter class January 1, 1953 1/ --Continued

HARDWOODS--Continued

Species group and d.b.h. class (inches)	Total East	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords
Sweetgum:											
5.0 - 6.9	14.0	1.4	..	1.0	..	0.3	0.1	12.6	3.5	5.8	3.3
7.0 - 8.9	19.0	1.7	..	1.0	..	.7	(3/)	17.3	5.0	7.5	4.8
9.0 - 10.9	25.4	1.0	..	..	..	.8	.2	24.4	5.8	11.3	7.3
11.0 and larger	79.3	6.3	..	3.0	..	2.7	.6	73.0	18.6	25.8	28.6
Total	137.7	10.4	..	5.0	..	4.5	.9	127.3	32.9	50.4	44.0
Tupelo and blackgum:											
5.0 - 6.9	9.2	.2	..	..	..	.2	(3/)	9.0	2.8	4.8	1.4
7.0 - 8.9	15.4	.5	..	..	..	.4	.1	14.9	4.7	7.6	2.6
9.0 - 10.9	23.1	1.8	..	1.0	..	.7	.1	21.3	6.6	10.7	4.0
11.0 and larger	72.1	5.2	..	2.0	..	2.9	.3	66.9	22.4	25.4	19.1
Total	119.8	7.7	..	3.0	..	4.2	.5	112.1	36.5	48.5	27.1
Yellow-poplar:											
5.0 - 6.9	6.5	2.7	..	2.0	..	.7	..	3.8	2.5	1.3	(2/)
7.0 - 8.9	9.0	3.4	..	2.0	..	1.4	..	5.6	3.5	2.1	(2/)
9.0 - 10.9	11.5	4.8	..	3.0	..	1.8	..	6.7	3.8	2.9	(2/)
11.0 and larger	44.4	17.8	(2/)	8.0	..	9.8	..	26.6	14.6	11.8	.2
Total	71.4	28.7	(2/)	15.0	..	13.7	..	42.7	24.4	18.1	.2
Cottonwood and aspen:											
5.0 - 6.9	26.7	26.3	2.0	1.0	21.6	.2	1.5	.4	.1	.1	.2
7.0 - 8.9	26.0	25.4	1.0	2.0	20.6	.2	1.6	.6	.2	.2	.2
9.0 - 10.9	16.7	16.1	..	1.0	13.8	.5	.8	.6	.1	.2	.3
11.0 and larger	25.9	21.4	1.0	1.0	11.1	4.6	3.7	4.5	.2	1.8	2.5
Total	95.3	89.2	4.0	5.0	67.1	5.5	7.6	6.1	.6	2.3	3.2
Other hardwoods:											
5.0 - 6.9	79.4	59.7	18.0	14.0	14.6	10.9	2.2	19.7	6.7	8.3	4.7
7.0 - 8.9	90.5	65.5	17.0	16.0	14.8	15.0	2.7	25.0	7.3	10.9	6.8
9.0 - 10.9	97.5	70.2	17.0	18.0	15.1	16.5	3.6	27.3	7.2	11.9	8.2
11.0 and larger	262.4	179.0	24.0	54.0	34.2	55.3	11.5	83.4	19.5	27.7	36.2
Total	529.8	374.4	76.0	102.0	78.7	97.7	20.0	155.4	40.7	58.8	55.9
All hardwoods:											
5.0 - 6.9	259.7	169.4	33.0	52.0	46.6	32.8	5.0	90.3	28.5	38.6	23.2
7.0 - 8.9	328.8	203.7	38.0	61.0	48.7	50.4	5.6	125.1	39.0	54.0	32.1
9.0 - 10.9	372.9	212.9	37.0	66.0	43.3	60.3	6.3	160.0	47.9	69.0	43.1
11.0 and larger	1,119.2	592.5	71.0	184.0	94.8	222.4	20.3	526.7	141.8	195.3	189.6
Total	2,080.6	1,178.5	179.0	363.0	233.4	365.9	37.2	902.1	257.2	356.9	288.0
ALL SPECIES											
All species:											
5.0 - 6.9	400.8	220.2	50.0	61.0	68.5	35.4	5.3	180.6	57.7	86.3	36.6
7.0 - 8.9	525.3	265.5	62.0	74.0	69.3	54.2	6.0	259.8	81.5	123.7	54.6
9.0 - 10.9	551.2	263.4	59.0	78.0	56.7	63.0	6.7	287.8	82.8	134.4	70.6
11.0 and larger	1,588.5	721.7	132.0	218.0	120.7	229.6	21.4	866.8	238.4	333.0	295.4
Total	3,065.8	1,470.8	303.0	431.0	315.2	382.2	39.4	1,595.0	460.4	677.4	457.2

1/ Prepared by Forest Service, U. S. Department of Agriculture.
Net volume in standard cords (128 cu. ft.) including bark.
2/ Less than 0.5 million cords.
3/ Less than 0.05 million cords.
4/ Includes 1.0 million cords of ponderosa pine.

Table 31.--Net volume of growing stock on commercial forest land in the United States and Coastal Alaska by ownership class, section and region, and by softwoods and hardwoods, January 1, 1953 1/

NORTH

Region and species group	All ownerships	Federal ownership or trusteeship: Total	National forest	Indian 2/	Bureau of land management 2/	Other 2/	State 2/	County and municipal 2/	Private: Total	Farm	Industrial and other
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
New England:											
Softwood	9,957	472	451	..	..	21	..	..	..	..	..
Hardwood	14,388	621	587	..	..	34	..	..	..	..	..
Total	24,345	1,093	1,038	..	..	55	474	204	22,574	5,949	16,625
Middle Atlantic:											
Softwood	5,390	110	77	..	..	33	..	..	..	..	..
Hardwood	29,093	948	826	..	..	122	..	..	..	..	..
Total	34,483	1,058	903	..	..	155	2,539	218	30,668	9,488	21,180
Lake States:											
Softwood	6,543	1,678	1,260	354	14	50	..	..	..	..	..
Hardwood	18,675	2,590	1,939	502	8	141	..	..	..	..	..
Total	25,218	4,268	3,199	856	22	191	2,953	1,972	16,025	7,651	8,374
Central:											
Softwood	1,042	76	61	(3/)	(3/)	15	..	..	..	..	..
Hardwood	23,582	1,309	1,053	(3/)	(3/)	256	..	..	..	..	..
Total	24,624	1,385	1,114	(3/)	(3/)	271	296	36	22,907	14,367	8,540
Plains:											
Softwood	214	87	72	15	..	(3/)	..	..	..	..	..
Hardwood	2,614	313	(1/)	272	4	37	..	..	..	..	..
Total	2,828	400	72	287	4	37	40	..	2,388	1,762	626
Total North:											
Softwood	23,146	2,423	1,921	369	14	119	..	..	..	..	..
Hardwood	88,352	5,781	4,405	774	12	590	..	..	..	..	..
Total	111,498	8,204	6,326	1,143	26	709	6,302	2,430	94,562	39,217	55,345
SOUTH											
South Atlantic:											
Softwood	14,877	945	660	5	..	280	..	..	..	..	..
Hardwood	18,881	1,486	1,301	20	..	165	..	..	..	..	..
Total	33,758	2,431	1,961	25	..	445	257	61	31,009	21,257	9,752
Southeast:											
Softwood	23,501	2,171	1,383	7	7	774	..	..	..	..	..
Hardwood	24,454	1,495	1,021	6	5	463	..	..	..	..	..
Total	47,955	3,666	2,404	13	12	1,237	469	372	43,448	21,557	21,891
West Gulf:											
Softwood	12,689	1,540	1,462	2	13	63	..	..	..	..	..
Hardwood	19,299	1,220	917	5	56	242	..	..	..	..	..
Total	31,988	2,760	2,379	7	69	305	220	5	29,003	6,628	22,375
Total South:											
Softwood	51,067	4,656	3,505	14	20	1,117	..	..	..	..	..
Hardwood	62,634	4,201	3,239	31	61	870	..	..	..	..	..
Total	113,701	8,857	6,744	45	81	1,987	946	438	103,460	49,442	54,018
WEST											
Pacific Northwest:											
Douglas-fir subregion:											
Softwood	107,601	52,543	40,671	1,266	10,434	172	..	..	..	..	..
Hardwood	5,570	1,210	853	91	266	..	..	..	..	..	..
Total	113,171	53,753	41,524	1,357	10,700	172	5,589	1,262	52,567	2,488	50,079
Pine subregion:											
Softwood	32,980	23,114	18,149	4,402	532	31	..	..	..	..	..
Hardwood	43	28	21	7	..	..	..	..	..	..	..
Total	33,023	23,142	18,170	4,409	532	31	990	78	8,813	604	8,209
Total Pacific Northwest:											
Softwood	140,581	75,657	58,820	5,668	10,966	203	..	..	..	..	..
Hardwood	5,613	1,238	874	98	266	..	..	..	..	..	..
Total	146,194	76,895	59,694	5,766	11,232	203	6,579	1,340	61,380	3,092	58,288
California:											
Softwood	63,664	32,977	31,216	645	1,045	71	..	..	..	..	..
Hardwood	3,047	934	870	11	47	6	..	..	..	..	..
Total	66,711	33,911	32,086	656	1,092	77	827	34	31,939	6,157	25,782

Table 31.--Net volume of growing stock on commercial forest land in the United States and Coastal Alaska by ownership class, section and region, and by softwoods and hardwoods, January 1, 1953[1] --Continued

WEST--Continued

Region and species group	All ownerships	Federal ownership or trusteeship: Total	National forest	Indian[2]	Bureau of land management[2]	Other[2]	State[2]	County and municipal[2]	Private: Total	Farm	Industrial and other
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
Northern Rocky Mountain:											
Softwood	42,290	30,047	28,259	678	1,100	10	..	..	..	..	..
Hardwood	473	201	119	78	4	..	..	..	..	..	..
Total	42,763	30,248	28,378	756	1,104	10	2,685	39	9,791	2,936	6,855
Southern Rocky Mountain:											
Softwood	15,934	13,592	11,681	1,265	618	28	..	..	..	..	..
Hardwood	1,638	1,154	1,051	38	58	7	..	..	..	..	..
Total	17,572	14,746	12,732	1,303	676	35	275	17	2,534	1,645	889
Total West:											
Softwood	262,469	152,273	129,976	8,256	13,729	312	..	..	..	..	..
Hardwood	10,771	3,527	2,914	225	375	13	..	..	..	..	..
Total	273,240	155,800	132,890	8,481	14,104	325	10,366	1,430	105,644	13,830	91,814
SUMMARY											
Continental United States:											
Softwood	336,682	159,352	135,402	8,639	13,763	1,548	..	..	..	..	..
Hardwood	161,757	13,509	10,558	1,030	448	1,473	..	..	..	..	..
Total	498,439	172,861	145,960	9,669	14,211	3,021	17,614	4,298	303,666	102,489	201,177
Coastal Alaska:											
Softwood	18,473	18,407	17,130	13	1,264	..	..	..	..	..	..
Hardwood	23	22	9	..	13	..	..	..	..	..	..
Total	18,496	18,429	17,139	13	1,277	..	..	..	67	..	67
All Regions:											
Softwood	355,155	177,759	152,532	8,652	15,027	1,548	..	..	..	..	..
Hardwood	161,780	13,531	10,567	1,030	461	1,473	..	..	..	..	..
Total	516,935	191,290	163,099	9,682	15,488	3,021	17,614	4,298	303,733	102,489	201,244

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net volume in cubic feet excluding bark. Estimates of net volume by softwoods and hardwoods not obtained for ownerships other than Federal.

2/ Because of different definitions of commercial forest land, different cruising standards, specifications, and log rules adopted by the Forest Service and other public agencies, volume estimates for these ownerships may vary from actual published figures of the public agencies concerned.

3/ Less than 0.5 million cubic feet.

Table 32.--Net volume of all timber on commercial forest land in the United States and Coastal Alaska by class of material, section and region, and by softwoods and hardwoods, January 1, 1953[1/]

Section, region, and species group	Total, all timber	Growing stock								Salvable dead trees		
		Total	Sawtimber trees			Poletimber trees	Sound cull trees	Rotten cull trees	Hardwood limbs	Total	Sawtimber	Poletimber
			Total	Sawlog portion	Upper stems							
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
North:												
New England:												
Softwood	10,677	9,957	6,643	5,348	1,295	3,314	616	104	..	..	..	..
Hardwood	18,501	14,388	5,666	4,385	1,281	8,722	1,592	1,642	877	2	1	1
Total	29,178	24,345	12,309	9,733	2,576	12,036	2,208	1,746	877	2	1	1
Middle Atlantic												
Softwood	5,758	5,390	3,630	2,927	703	1,760	304	64	..	..	..	..
Hardwood	36,023	29,093	14,717	11,522	3,195	14,376	2,057	2,045	2,384	444	328	116
Total	41,781	34,483	18,347	14,449	3,898	16,136	2,361	2,109	2,384	444	328	116
Lake States:												
Softwood	6,858	6,543	3,147	2,534	613	3,396	92	214	..	9	5	4
Hardwood	23,331	18,675	7,575	6,231	1,344	11,100	828	2,141	1,667	20	11	9
Total	30,189	25,218	10,722	8,765	1,957	14,496	920	2,355	1,667	29	16	13
Central:												
Softwood	1,060	1,042	666	589	77	376	10	8	..	..	..	..
Hardwood	36,286	23,582	14,688	12,602	2,086	8,894	1,776	2,944	7,874	110	81	29
Total	37,346	24,624	15,354	13,191	2,163	9,270	1,786	2,952	7,874	110	81	29
Plains:												
Softwood	232	214	126	115	11	88	15	1	..	2	1	1
Hardwood	3,948	2,614	1,432	1,118	314	1,182	370	197	757	10	6	4
Total	4,180	2,828	1,558	1,233	325	1,270	385	198	757	12	7	5
Total North:												
Softwood	24,585	23,146	14,212	11,513	2,699	8,934	1,037	391	..	11	6	5
Hardwood	118,089	88,352	44,078	35,858	8,220	44,274	6,623	8,969	13,559	586	427	159
Total	142,674	111,498	58,290	47,371	10,919	53,208	7,660	9,360	13,559	597	433	164
South:												
South Atlantic:												
Softwood	15,951	14,877	10,258	8,331	1,927	4,619	951	119	..	4	2	2
Hardwood	27,146	18,881	11,219	9,098	2,121	7,662	3,507	1,961	2,769	28	14	14
Total	43,097	33,758	21,477	17,429	4,048	12,281	4,458	2,080	2,769	32	16	16
Southeast:												
Softwood	25,083	23,501	15,481	13,039	2,442	8,020	1,212	306	..	64	43	21
Hardwood	37,576	24,454	13,684	10,146	3,538	10,770	6,531	3,632	2,826	133	97	36
Total	62,659	47,955	29,165	23,185	5,980	18,790	7,743	3,938	2,826	197	140	57
West Gulf:												
Softwood	12,928	12,689	9,996	9,151	845	2,693	117	60	..	62	42	20
Hardwood	27,865	19,299	12,713	8,827	3,886	6,586	3,881	2,109	2,499	77	55	22
Total	40,793	31,988	22,709	17,978	4,731	9,279	3,998	2,169	2,499	139	97	42
Total South:												
Softwood	53,962	51,067	35,735	30,521	5,214	15,332	2,280	485	..	130	87	43
Hardwood	92,587	62,634	37,616	28,071	9,545	25,018	13,919	7,702	8,094	238	166	72
Total	146,549	113,701	73,351	58,592	14,759	40,350	16,199	8,187	8,094	368	253	115
West:												
Pacific Northwest:												
Douglas-fir subregion:												
Softwood	116,476	107,601	97,514	90,688	6,826	10,087	246	4,361	..	4,268	3,877	391
Hardwood	5,782	5,570	3,541	3,293	248	2,029	..	155	36	21	13	8
Total	122,258	113,171	101,055	93,981	7,074	12,116	246	4,516	36	4,289	3,890	399
Pine subregion:												
Softwood	33,870	32,980	27,695	25,663	2,032	5,285	56	280	..	554	524	30
Hardwood	45	43	34	30	4	9	..	2	(2/)	..	..	..
Total	33,915	33,023	27,729	25,693	2,036	5,294	56	282	(2/)	554	524	30
Total Pacific Northwest:												
Softwood	150,346	140,581	125,209	116,351	8,858	15,372	302	4,641	..	4,822	4,401	421
Hardwood	5,827	5,613	3,575	3,323	252	2,038	..	157	36	21	13	8
Total	156,173	146,194	128,784	119,674	9,110	17,410	302	4,798	36	4,843	4,414	429
California:												
Softwood	64,870	63,664	60,244	52,456	7,788	3,420	57	820	..	329	329	..
Hardwood	5,061	3,047	1,512	1,212	300	1,535	318	115	1,581	..	..	..
Total	69,931	66,711	61,756	53,668	8,088	4,955	375	935	1,581	329	329	..
Northern Rocky Mountain:												
Softwood	46,113	42,290	27,273	24,738	2,535	15,017	247	2,061	..	1,515	1,063	452
Hardwood	502	473	323	271	52	150	2	16	4	7	3	4
Total	46,615	42,763	27,596	25,009	2,587	15,167	249	2,077	4	1,522	1,066	456
Southern Rocky Mountain:												
Softwood	17,727	15,934	11,640	10,298	1,342	4,294	406	413	..	974	849	125
Hardwood	1,821	1,638	716	540	176	922	80	56	7	40	17	23
Total	19,548	17,572	12,356	10,838	1,518	5,216	486	469	7	1,014	866	148
Total West:												
Softwood	279,056	262,469	224,366	203,843	20,523	38,103	1,012	7,935	..	7,640	6,642	998
Hardwood	13,211	10,771	6,126	5,346	780	4,645	400	344	1,628	68	33	35
Total	292,267	273,240	230,492	209,189	21,303	42,748	1,412	8,279	1,628	7,708	6,675	1,033
Continental United States:												
Softwood	357,603	336,682	274,313	245,877	28,436	62,369	4,329	8,811	..	7,781	6,735	1,046
Hardwood	223,887	161,757	87,820	69,275	18,545	73,937	20,942	17,015	23,281	892	626	266
Total	581,490	498,439	362,133	315,152	46,981	136,306	25,271	25,826	23,281	8,673	7,361	1,312
Coastal Alaska:												
Softwood	23,728	18,473	17,073	16,049	1,024	1,400	225	4,972	..	58	58	..
Hardwood	29	23	21	20	1	2	(2/)	6	(2/)	..	..	..
Total	23,757	18,496	17,094	16,069	1,025	1,402	225	4,978	(2/)	58	58	..
All Regions:												
Softwood	381,331	355,155	291,386	261,926	29,460	63,769	4,554	13,783	..	7,839	6,793	1,046
Hardwood	223,916	161,780	87,841	69,295	18,546	73,939	20,942	17,021	23,281	892	626	266
Total	605,247	516,935	379,227	331,221	48,006	137,708	25,496	30,804	23,281	8,731	7,419	1,312

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net volume in cubic feet excluding bark.

2/ Less than 0.5 million cubic feet.

Table 33.--Net annual growth of live sawtimber on commercial forest land in Eastern United States by species group, and by section and region, 1952[1/]

Species group	Total Eastern U. S.	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Softwood:											
White, red, and jack pine	906	845	298	124	417	6	..	61	41	20	..
Southern yellow pine	14,155	317	2	107	..	184	24	13,838	3,493	6,378	3,967
Spruce-fir	742	741	426	67	248	..	..	1	1	..	..
Other softwoods	1,167	572	188	172	137	59	2/16	595	135	281	179
All softwoods	16,970	2,475	914	470	802	249	40	14,495	3,670	6,679	4,146
Hardwood:											
Yellow-poplar	948	323	5	155	..	163	..	625	383	239	3
Other soft hardwoods	6,041	2,678	70	391	1,239	742	236	3,363	1,018	1,254	1,091
Total	6,989	3,001	75	546	1,239	905	236	3,988	1,401	1,493	1,094
Oaks	7,316	3,486	125	983	440	1,872	66	3,830	1,334	1,257	1,239
Beech-yellow birch-hard maple	1,877	1,722	534	733	158	297	..	155	38	73	44
Other hard hardwoods	2,939	1,390	209	428	54	640	59	1,549	437	533	579
Total	12,132	6,598	868	2,144	652	2,809	125	5,534	1,809	1,863	1,862
All hardwoods	19,121	9,599	943	2,690	1,891	3,714	361	9,522	3,210	3,356	2,956
All species	36,091	12,074	1,857	3,160	2,693	3,963	401	24,017	6,880	10,035	7,102

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net annual growth in board feet log scale, International 1/4-inch rule.

2/ Net growth of ponderosa pine. The total net growth of ponderosa and Jeffrey pine in the United States is 1,857 million board feet including 16 million board feet in the Plains Region.

Table 34.--Net annual growth of live sawtimber on commercial forest land in Western United States and Coastal Alaska, by species group, and by section and region, 1952[1/]

Species group	Total Western U. S. and Coastal Alaska	West: Total West	Pacific Northwest: Total	Pacific Northwest: Douglas-fir subregion	Pacific Northwest: Pine subregion	California	Northern Rocky Mountain	Southern Rocky Mountain	Coastal Alaska
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Softwood:									
Douglas-fir	4,431	4,431	3,193	3,022	171	787	388	63	..
Ponderosa and Jeffrey pine	2/1,841	2/1,841	496	57	439	553	368	424	..
Western hemlock	1,038	967	931	911	20	9	27	..	71
White and sugar pine	535	535	119	98	21	207	209	..	..
Redwood	396	396	..	..	..	396	..	..	..
Other softwoods	2,800	2,744	1,095	922	173	943	516	190	56
Total	11,041	10,914	5,834	5,010	824	2,895	1,508	677	127
Hardwoods	265	264	143	139	4	44	26	51	1
All species	11,306	11,178	5,977	5,149	828	2,939	1,534	728	128

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net annual growth in board feet log scale, International 1/4-inch rule.

2/ Excludes 16 million board feet of net growth of ponderosa pine in the Plains Region. The total net growth of ponderosa and Jeffrey pine in the United States is 1,857 million board feet.

Table 35.--Net annual growth of growing stock on commercial forest land in Eastern United States, by species group and by section and region, 1952 1/

VOLUME IN CUBIC FEET

Species group	Total Eastern U. S.	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
Softwoods:											
White, red, and jack pine	270	254	83	32	139	(2/)	..	16	11	5	..
Southern yellow pine	3,483	87	1	48	..	33	5	3,396	920	1,630	846
Spruce-fir	291	290	145	23	122	..	..	1	1	..	..
Other softwoods	341	190	62	53	58	13	3/ 4	151	37	79	35
All softwoods	4,385	821	291	156	319	46	9	3,564	969	1,714	881
Hardwoods:											
Yellow-poplar	289	104	1	63	..	40	..	185	111	73	1
Other soft hardwoods	2,290	1,118	75	154	621	205	63	1,172	290	533	349
Total	2,579	1,222	76	217	621	245	63	1,357	401	606	350
Oaks	2,478	1,215	75	436	148	536	20	1,263	384	486	393
Beech-yellow birch-hard maple	718	671	252	272	77	70	..	47	11	23	13
Other hard hardwoods	1,306	730	184	276	15	231	24	576	143	227	206
Total	4,502	2,616	511	984	240	837	44	1,886	538	736	612
All hardwoods	7,081	3,838	587	1,201	861	1,082	107	3,243	939	1,342	962
All species	11,466	4,659	878	1,357	1,180	1,128	116	6,807	1,908	3,056	1,843

VOLUME IN CORDS

Species group	Total Eastern U. S.	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords	Million cords
Softwoods:											
White, red, and jack pine	2.9	2.8	1.0	(4/)	1.8	(5/)	..	0.1	0.1	(5/)	..
Southern yellow pine	49.0	1.6	(4/)	1.0	..	0.5	0.1	47.4	13.3	22.7	11.4
Spruce-fir	3.5	3.5	2.0	(4/)	1.5	..	..	..	..	..	..
Other softwoods	4.9	2.9	1.0	1.0	.7	.2	(5/)	2.0	.5	1.1	.4
All softwoods	60.3	10.8	4.0	2.0	4.0	.7	.1	49.5	13.9	23.8	11.8
Hardwoods:											
Yellow-poplar	4.4	1.6	(4/)	1.0	..	.6	..	2.8	1.7	1.1	(5/)
Other soft hardwoods	32.1	14.8	1.0	2.0	7.7	3.2	.9	17.3	4.2	7.8	5.3
Total	36.5	16.4	1.0	3.0	7.7	3.8	.9	20.1	5.9	8.9	5.3
Oaks	35.1	16.5	1.0	5.0	1.8	8.3	.4	18.6	5.6	7.1	5.9
Beech-yellow birch-hard maple	8.7	8.1	3.0	3.0	.9	1.2	..	.6	.2	.3	.1
Other hard hardwoods	18.9	10.2	2.0	4.0	.3	3.6	.3	8.7	2.1	3.5	3.1
Total	62.7	34.8	6.0	12.0	3.0	13.1	.7	27.9	7.9	10.9	9.1
All hardwoods	99.2	51.2	7.0	15.0	10.7	16.9	1.6	48.0	13.8	19.8	14.4
All species	159.5	62.0	11.0	17.0	14.7	17.6	1.7	97.5	27.7	43.6	26.2

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net annual growth in cubic feet excluding bark and in standard cords (128 cu. ft.) including bark.
2/ Less than 0.5 million cubic feet.
3/ Ponderosa pine. The total net growth of ponderosa and Jeffrey pine in the United States is 483 million cubic feet including 4 million cubic feet in the Plains Region.
4/ Less than 0.5 million cords.
5/ Less than 0.05 million cords.

Table 36.--Net annual growth of growing stock on commercial forest land in Western United States and Coastal Alaska, by species group, and by section and region, 1952 1/

Species group	Total Western U. S. and Coastal Alaska	West: Total West	Pacific Northwest: Total	Pacific Northwest: Douglas-fir subregion	Pacific Northwest: Pine subregion	California	Northern Rocky Mountain	Southern Rocky Mountain	Coastal Alaska
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
Softwoods:									
Douglas-fir	902	902	589	529	60	144	150	19	..
Ponderosa and Jeffrey pine	2/ 479	2/ 479	167	8	159	99	108	105	..
Western hemlock	237	219	208	205	3	2	9	..	18
White and sugar pine	100	100	22	14	8	32	46	(3/)	..
Redwood	77	77	..	..	..	77	..	..	..
Other softwoods	833	819	286	187	99	185	278	70	14
Total	2,628	2,596	1,272	943	329	539	591	194	32
Hardwoods	149	149	55	55	..	56	12	26	(3/)
All species	2,777	2,745	1,327	998	329	595	603	220	32

1/ Prepared by Forest Service, U. S. Department of Agriculture. Net annual growth in cubic feet excluding bark.
2/ Excludes 4 million cubic feet of ponderosa pine in the Plains Region. The total net annual growth of ponderosa and Jeffrey pine in the United States is 483 million cubic feet.
3/ Less than 0.5 million cubic feet.

Table 37.--Output and source of timber products in the United States and Coastal Alaska, by product and by softwoods and hardwoods, 1952[1]

Product and species group	Standard unit	Output from all sources: Total	Output from all sources: From plant residues	Output from all sources: From roundwood	Output from roundwood: All roundwood	Growing stock: Total	Growing stock: Sawtimber trees	Growing stock: Poletimber trees	Dead trees	Cull trees and limbs[2]	Other[3]
		Units	Units	Units	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
Sawlogs (for lumber, timbers, sawn ties, etc.):											
Softwood	M bd. ft. lumber tally	31,507,051	30,195	31,476,856	4,920,670	4,602,113	..	..	283,002	32,477	3,078
Hardwood	do.	8,003,126	..	8,003,126	1,225,293	1,198,613	..	..	3,394	21,391	1,895
Total		39,510,177	30,195	39,479,982	6,145,963	5,800,726	5,623,774	176,952	286,396	53,868	4,973
Veneer logs and bolts:											
Softwood	M bd. ft. log scale	1,548,223	..	1,548,223	248,758	218,942	..	..	28,749	1,005	62
Hardwood	do.	919,113	..	919,113	173,374	172,990	..	..	6	368	10
Total		2,467,336	..	2,467,336	422,132	391,932	390,649	1,283	28,755	1,373	72
Cooperage logs and bolts:											
Softwood	do.	117,935	..	117,935	26,420	25,610	..	..	334	440	36
Hardwood	do.	237,390	..	237,390	46,527	46,318	..	..	..	205	4
Total		355,325	..	355,325	72,947	71,928	70,016	1,912	334	645	40
Pulpwood:											
Softwood	Standard cords	21,410,653	1,399,686	20,010,967	1,550,346	1,407,194	..	..	26,458	107,055	9,639
Hardwood	do.	3,657,126	168,070	3,489,056	272,799	248,492	..	..	7,550	16,468	289
Total		25,067,779	1,567,756	23,500,023	1,823,145	1,655,686	921,668	734,018	34,008	123,523	9,928
Fuelwood:											
Softwood	do.	31,065,258	24,931,050	6,134,208	475,627	231,712	..	..	104,034	103,621	36,260
Hardwood	do.	27,536,659	6,454,091	21,082,568	1,532,188	733,787	..	..	275,134	342,625	180,642
Total		58,601,917	31,385,141	27,216,776	2,007,815	965,499	500,406	465,093	379,168	446,246	216,902
Piling:											
Softwood	M linear ft.	37,847	..	37,847	25,912	25,900	..	..	..	11	1
Hardwood	do.	3,342	..	3,342	2,087	2,068	..	..	..	3	16
Total		41,189	..	41,189	27,999	27,968	26,993	975	..	14	17
Poles:											
Softwood	M pieces	6,421	..	6,421	87,026	87,021	..	..	1	..	4
Hardwood	do.	55	..	55	611	590	..	..	..	..	21
Total		6,476	..	6,476	87,637	87,611	78,738	8,873	1	..	25
Posts (round and split):											
Softwood	do.	103,304	8	103,296	68,993	46,786	..	..	5,760	12,210	4,237
Hardwood	do.	202,682	92	202,590	125,087	80,522	..	..	5,384	16,621	22,560
Total		305,986	100	305,886	194,080	127,308	41,296	86,012	11,144	28,831	26,797
Hewn ties:											
Softwood	do.	3,701	..	3,701	23,142	22,747	..	..	1	394	..
Hardwood	do.	6,478	..	6,478	44,214	43,833	..	..	..	381	..
Total		10,179	..	10,179	67,356	66,580	65,481	1,099	1	775	..
Mine timbers (round):											
Softwood	M cubic feet	18,517	9	18,508	18,508	16,574	..	..	1,522	360	52
Hardwood	do.	62,452	..	62,452	62,452	55,555	..	..	392	6,497	8
Total		80,969	9	80,960	80,960	72,129	20,579	51,550	1,914	6,857	60

Table 37.--Output and source of timber products in the United States and Coastal Alaska, by product and by softwoods and hardwoods, 1952[1/]--Continued

Product and species group	Output from all sources: Standard unit	Output from all sources: Total	Output from all sources: From plant residues	Output from all sources: From roundwood	Output from roundwood: All roundwood	Growing stock: Total	Growing stock: Sawtimber trees	Growing stock: Poletimber trees	Dead trees	Cull trees and limbs[2/]	Other[3/]
		Units	Units	Units	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
Other:[4/]											
Softwood	M cubic feet	112,306	35,990	76,316	76,316	52,923	..	..	20,296	3,097	..
Hardwood	do.	114,697	23,206	91,491	91,491	72,310	..	..	6,776	11,398	1,007
Total		227,003	59,196	167,807	167,807	125,233	76,731	48,502	27,072	14,495	1,007
Total all products:											
Softwood	..	..	..	..	7,521,718	6,737,522	..	..	470,157	260,670	53,369
Hardwood	..	..	..	..	3,576,123	2,655,078	..	..	298,636	415,957	206,452
Total		..	..	..	11,097,841	9,392,600	7,816,331	1,576,269	768,793	676,627	259,821

1/ Prepared by Forest Service, U. S. Department of Agriculture. Output from roundwood is shown both in cubic feet roundwood, excluding bark, and in units of measure commonly used by the Bureau of the Census, the trade, or other agencies reporting output of various products, i.e., sawlogs for lumber, timbers, sawn ties, etc., in board feet lumber tally; veneer and cooperage logs and bolts, in board feet log scale; pulpwood and fuelwood, in standard cords (128 cu. ft.) including bark, etc. Output from plant residues and total output from all sources are shown in units commonly used for various products.

2/ In addition to cull trees and limbs includes for some products trees of commercial species less than 5.0 inches in diameter and tops less than 4.0 inches in diameter.

3/ Trees on noncommercial forest land, fence rows, stream margins, orchards, etc.

4/ Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and bolts for other such miscellaneous products.

Table 38.--Timber products output in the United States and Coastal Alaska, by product, by section and region of origin and by softwoods and hardwoods, 1952[1/]

Section, region, and species group	Sawlogs (for: lumber, etc.)	Veneer logs and bolts	Cooperage: logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round & split)	Hewn ties	Mine timbers (round)	Other
	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Number cords	Number cords	Thousand linear feet	Thousand pieces	Thousand pieces	Thousand pieces	Thousand cu. ft.	Thousand cu. ft.
North:											
New England:											
Softwood	1,060,487	2	15,310	1,943,401	570,041	355	17	2,130	..	..	274
Hardwood	287,310	66,451	532	464,141	846,680	130	..	760	..	..	1,552
Total	1,347,797	66,453	15,842	2,407,542	1,416,721	485	17	2,890	..	..	1,826
Middle Atlantic:											
Softwood	496,552	788	..	605,169	350,777	3,945	6	2,270	..	55	695
Hardwood	1,164,591	41,045	8,237	475,048	2,038,556	2,137	..	23,218	..	33,911	12,569
Total	1,661,143	41,833	8,237	1,080,217	2,389,333	6,082	6	25,488	..	33,966	13,264
Lake States:											
Softwood	290,400	339	..	1,395,344	762,600	242	172	14,245	..	4,959	1,401
Hardwood	715,610	70,105	1,450	835,849	3,986,870	431	..	11,135	..	1,729	24,548
Total	1,006,010	70,444	1,450	2,231,193	4,749,470	673	172	25,380	..	6,688	25,949
Central:											
Softwood	87,408	327	..	5,580	872	..	16	7,014	..	..	465
Hardwood	1,239,767	52,766	93,972	129,420	4,034,928	258	..	37,256	268	18,155	13,413
Total	1,327,175	53,093	93,972	135,000	4,035,800	258	16	44,270	268	18,155	13,878
Plains:											
Softwood	10,783	..	..	7,706	16,664	..	6	15,157	..	..	..
Hardwood	45,556	5,261	..	..	1,252,268	..	4	39,443	..	..	520
Total	56,339	5,261	..	7,706	1,268,932	..	10	54,600	..	..	520
Total, North:											
Softwood	1,945,630	1,456	15,310	3,957,200	1,700,954	4,542	217	40,816	..	5,014	2,835
Hardwood	3,452,834	235,628	104,191	1,904,458	12,159,302	2,956	4	111,812	268	53,795	52,602
Total	5,398,464	237,084	119,501	5,861,658	13,860,256	7,498	221	152,628	268	58,809	55,437
South:											
South Atlantic:											
Softwood	3,005,343	14,062	19,844	3,126,109	4,985,116	4,743	516	15,941	141	1,023	12,537
Hardwood	1,460,484	224,628	2,775	627,515	4,518,104	325	..	17,484	430	5,535	19,201
Total	4,465,827	238,690	22,619	3,753,624	9,503,220	5,068	516	33,425	571	6,558	31,738
Southeast:											
Softwood	4,510,907	18,690	64,863	7,082,134	4,646,419	10,158	2,320	18,699	2,662	2,866	9,793
Hardwood	2,006,159	312,697	81,424	795,214	6,922,792	35	..	45,792	2,030	2,610	25,223
Total	6,517,066	331,387	146,287	7,877,348	11,569,211	10,193	2,320	64,491	4,692	5,476	35,016
West Gulf:											
Softwood	2,094,000	4,869	..	2,764,474	2,922,165	11,460	2,130	15,100	890	284	5,826
Hardwood	1,061,000	146,160	49,000	280,028	3,684,012	..	50	26,100	3,750	506	16,083
Total	3,155,000	151,029	49,000	3,044,502	6,606,177	11,460	2,180	41,200	4,640	790	21,909
Total, South:											
Softwood	9,610,250	37,621	84,707	12,972,717	12,553,700	26,361	4,966	49,740	3,693	4,173	28,156
Hardwood	4,527,643	683,485	133,199	1,702,757	15,124,908	360	50	89,376	6,210	8,651	60,507
Total	14,137,893	721,106	217,906	14,675,474	27,678,608	26,721	5,016	139,116	9,903	12,824	88,663
West:											
Pacific Northwest:											
Douglas-fir subregion:											
Softwood	10,503,169	1,216,791	13,388	3,827,568	10,519,817	5,500	475	1,695	..	163	59,411
Hardwood	21,199	..	..	47,936	7,662	..	..	67	..	..	60
Total	10,524,368	1,216,791	13,388	3,875,504	10,527,479	5,500	475	1,762	..	163	59,471
Pine subregion:											
Softwood	1,951,628	12,963	..	71,302	2,186,658	..	104	4,463	..	430	4,523
Hardwood	..	..	..	235	..	..	..	..	..	..	..
Total	1,951,628	12,963	..	71,537	2,186,658	..	104	4,463	..	430	4,523
Total, Pacific Northwest:											
Softwood	12,454,797	1,229,754	13,388	3,898,870	12,706,475	5,500	579	6,158	..	593	63,934
Hardwood	21,199	..	..	48,171	7,662	..	..	67	..	..	60
Total	12,475,996	1,229,754	13,388	3,947,041	12,714,137	5,500	579	6,225	..	593	63,994

Table 38.--Timber products output in the United States and Coastal Alaska, by product, by section and region of origin and by softwoods and hardwoods, 1952[1/] - Continued

Section, region, and species group	Sawlogs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round & split)	Hewn ties	Mine timbers (round)	Other
	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Number cords	Number cords	Thousand linear feet	Thousand pieces	Thousand pieces	Thousand pieces	Thousand cu. ft.	Thousand cu. ft.
West: - Continued											
California:											
Softwood	4,902,411	270,842	4,530	269,243	2,330,823	1,090	45	2,000	8	455	10,211
Hardwood	600	..	..	52	34,000	26	..	1,400	..	(2/)	560
Total	4,903,011	270,842	4,530	269,295	2,364,823	1,116	45	3,400	8	455	10,771
Northern Rocky Mountain:											
Softwood	1,964,810	8,525	..	295,275	1,046,188	21	480	3,301	..	6,374	3,966
Hardwood	185	..	..	1,688	22,245	..	..	1	..	2	..
Total	1,964,995	8,525	..	296,963	1,068,433	21	480	3,302	..	6,376	3,966
Southern Rocky Mountain:											
Softwood	555,333	..	..	14,502	673,444	16	134	1,271	..	1,908	3,174
Hardwood	665	..	..	..	187,042	..	1	26	..	4	968
Total	555,998	..	..	14,502	860,486	16	135	1,297	..	1,912	4,142
Total, West:											
Softwood	19,877,351	1,509,121	17,918	4,477,890	16,756,930	6,627	1,238	12,730	8	9,330	81,285
Hardwood	22,649	..	..	49,911	250,949	26	1	1,494	..	6	1,588
Total	19,900,000	1,509,121	17,918	4,527,801	17,007,879	6,653	1,239	14,224	8	9,336	82,873
Continental United States:											
Softwood	31,433,231	1,548,198	117,935	21,407,807	31,011,584	37,530	6,421	103,286	3,701	18,517	112,276
Hardwood	8,003,126	919,113	237,390	3,657,126	27,535,159	3,342	55	202,682	6,478	62,452	114,697
Total	39,436,357	2,467,311	355,325	25,064,933	58,546,743	40,872	6,476	305,968	10,179	80,969	226,973
Coastal Alaska:											
Softwood	73,820	25	..	2,846	53,674	317	(3/)	18	..	..	30
Hardwood	..	..	..	..	1,500	..	..	..	..	..	..
Total	73,820	25	..	2,846	55,174	317	(3/)	18	..	..	30
All Regions:											
Softwood	31,507,051	1,548,223	117,935	21,410,653	31,065,258	37,847	6,421	103,304	3,701	18,517	112,306
Hardwood	8,003,126	919,113	237,390	3,657,126	27,536,659	3,342	55	202,682	6,478	62,452	114,697
Total	39,510,177	2,467,336	355,325	25,067,779	58,601,917	41,189	6,476	305,986	10,179	80,969	227,003

1/ Prepared by Forest Service, U. S. Department of Agriculture. Estimates of timber products output include both roundwood and plant residues. The output from roundwood is according to sections and regions where the logs, bolts, and other round timbers, cut for various products, originated and not necessarily where they were processed into lumber, pulp, veneer or other manufactured products or used in round form as poles, piling, posts, etc. The volume of plant residues such as used for fuelwood or chipped for pulp is, however, according to sections and regions where used. Volumes are in units of measure commonly used by the Bureau of the Census, the trade, or other agencies reporting volume of output, i.e., sawlogs for lumber, timbers, sawn ties, etc., in board feet lumber tally; veneer and cooperage logs and bolts, in board feet log scale; pulpwood and fuelwood, in standard cords (128 cu. ft.) including bark, etc. Volumes for mine timbers and "all other products" including box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, etc., are shown in cubic feet excluding bark.

2/ Less than 0.5 thousand cubic feet.

3/ Less than 0.5 thousand pieces.

C-SUPERVISION
Timber Resource Review

Table 39.--Timber products output from roundwood and plant residues in the United States and Coastal Alaska, by section, region of origin, and by softwoods and hardwoods, 1952[1]

Section, region, and species group	Sawlogs (for lumber, etc.)			Veneer logs and bolts	Pulpwood			Fuelwood			All other products		
	Total	Plant residues	Roundwood	Roundwood	Total	Plant residues	Roundwood	Total	Plant residues	Roundwood	Total	Plant residues	Roundwood
	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Number cords	Number cords	Number cords	Number cords	Number cords	Number cords	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
North:													
New England:													
Softwood	1,060,487	..	1,060,487	2	1,943,401	..	1,943,401	570,041	504,607	65,434	6,208	140	6,068
Hardwood	287,310	..	287,310	66,451	464,141	6,442	457,699	846,680	205,689	640,991	2,348	562	1,786
Total	1,347,797	..	1,347,797	66,453	2,407,542	6,442	2,401,100	1,416,721	710,296	706,425	8,556	702	7,854
Middle Atlantic:													
Softwood	496,552	..	496,552	788	605,169	..	605,169	350,777	284,153	66,624	5,046	..	5,046
Hardwood	1,164,591	..	1,164,591	41,045	475,048	3,800	471,248	2,038,556	548,882	1,489,674	64,100	4,773	59,327
Total	1,661,143	..	1,661,143	41,833	1,080,217	3,800	1,076,417	2,389,333	833,035	1,556,298	69,146	4,773	64,373
Lake States:													
Softwood	290,400	..	290,400	339	1,395,344	5,714	1,389,630	762,600	337,083	425,517	18,684	..	18,684
Hardwood	715,610	..	715,610	70,105	835,849	6,771	829,078	3,986,870	568,449	3,418,421	35,166	6,500	28,666
Total	1,006,010	..	1,006,010	70,444	2,231,193	12,485	2,218,708	4,749,470	905,532	3,843,938	53,850	6,500	47,350
Central:													
Softwood	87,408	..	87,408	327	5,580	..	5,580	872	..	872	5,201	157	5,044
Hardwood	1,239,767	..	1,239,767	52,766	129,420	6,643	122,777	4,034,928	620,325	3,414,603	74,712	4,526	70,186
Total	1,327,175	..	1,327,175	53,093	135,000	6,643	128,357	4,035,800	620,325	3,415,475	79,913	4,683	75,230
Plains:													
Softwood	10,783	..	10,783	..	7,706	..	7,706	16,664	1,875	14,789	6,142	..	6,142
Hardwood	45,556	..	45,556	5,261	..	..	..	1,252,268	21,987	1,230,281	17,526	99	17,427
Total	56,339	..	56,339	5,261	7,706	..	7,706	1,268,932	23,862	1,245,070	23,668	99	23,569
Total North:													
Softwood	1,945,630	..	1,945,630	1,456	3,957,200	5,714	3,951,486	1,700,954	1,127,718	573,236	41,281	297	40,984
Hardwood	3,452,834	..	3,452,834	235,628	1,904,458	23,656	1,880,802	12,159,302	1,965,332	10,193,970	193,852	16,460	177,392
Total	5,398,464	..	5,398,454	237,084	5,861,658	29,370	5,832,288	13,860,[illegible]56	3,093,050	10,767,206	235,133	16,757	218,376
South:													
South Atlantic:													
Softwood	3,005,343	..	3,005,343	14,[illegible]62	3,126,109	8,829	3,117,280	4,985,116	2,458,651	2,526,465	39,427	1,564	37,863
Hardwood	1,460,484	..	1,460,484	224,628	627,515	76,843	550,672	4,518,104	1,483,287	3,034,817	39,536	1,889	37,647
Total	4,465,827	..	4,465,827	238,690	3,753,624	85,672	3,667,952	9,503,220	3,941,938	5,561,282	78,963	3,453	75,510
Southeast:													
Softwood	4,510,907	..	4,510,907	18,690	7,082,134	6,271	7,075,863	4,646,419	3,261,071	1,385,348	92,301	2,636	89,665
Hardwood	2,006,159	..	2,006,159	312,697	795,214	50,328	744,886	6,922,792	1,826,807	5,095,985	88,589	3,549	85,040
Total	6,517,066	..	6,517,066	331,387	7,877,348	56,599	7,820,749	11,569,211	5,087,878	6,481,333	180,890	6,185	174,705
West Gulf:													
Softwood	2,094,000	..	2,094,000	4,869	2,764,474	6,858	2,757,616	2,922,165	2,512,238	409,927	55,221	3,266	51,955
Hardwood	1,061,000	..	1,061,000	146,160	280,028	16,943	263,085	3,684,012	1,178,665	2,505,347	70,753	1,453	69,300
Total	3,155,000	..	3,155,000	151,029	3,044,502	23,801	3,020,701	6,606,177	3,690,903	2,915,274	125,974	4,719	121,255
Total South:													
Softwood	9,610,250	..	9,610,250	37,621	12,972,717	21,958	12,950,759	12,553,700	8,231,960	4,321,740	186,949	7,466	179,483
Hardwood	4,527,643	..	4,527,643	683,485	1,702,757	144,114	1,558,643	15,124,908	4,488,759	10,636,149	198,878	6,891	191,987
Total	14,137,893	..	14,137,893	721,106	14,675,474	166,072	14,509,402	27,678,608	12,720,719	14,957,889	385,827	14,357	371,470
West:													
Pacific Northwest:													
Douglas-fir subregion:													
Softwood	10,503,169	23,110	10,480,059	1,216,791	3,827,568	1,167,071	2,660,497	10,519,817	9,971,861	547,956	77,348	11,995	65,353
Hardwood	21,199	..	21,199	..	47,936	300	47,636	7,662	..	7,662	113	..	113
Total	10,524,368	23,110	10,501,258	1,216,791	3,875,504	1,167,371	2,708,133	10,527,479	9,971,861	555,618	77,461	11,995	65,466

Table 39.--Timber products output from roundwood and plant residues in the United States and Coastal Alaska, by section, region of origin, and by softwoods and hardwoods, 1952[1/] --Continued

Section, region, and species group	Sawlogs (for lumber, etc.) Total	Sawlogs Plant residues	Sawlogs Roundwood	Veneer logs and bolts Roundwood	Pulpwood Total	Pulpwood Plant residues	Pulpwood Roundwood	Fuelwood Total	Fuelwood Plant residues	Fuelwood Roundwood	All other products Total	All other products Plant residues	All other products Roundwood
	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Number cords	Number cords	Number cords	Number cords	Number cords	Number cords	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
West: --Continued													
Pacific Northwest:													
Pine subregion:													
Softwood	1,951,628	..	1,951,628	12,963	71,302	8,486	62,816	2,186,658	2,048,623	138,035	10,703	4,317	6,386
Hardwood	..	..	..	..	235	..	235	..	..	..	..	..	..
Total	1,951,628	..	1,951,628	12,963	71,537	8,486	63,051	2,186,658	2,048,623	138,035	10,703	4,317	6,386
Total Pacific Northwest:													
Softwood	12,454,797	23,110	12,431,687	1,229,754	3,898,870	1,175,557	2,723,313	12,706,475	12,020,484	685,991	88,051	16,312	71,739
Hardwood	21,199	..	21,199	..	48,171	300	47,871	7,662	..	7,662	113	..	113
Total	12,475,996	23,110	12,452,886	1,229,754	3,947,041	1,175,857	2,771,184	12,714,137	12,020,484	693,653	88,164	16,312	71,852
California:													
Softwood	4,902,411	7,085	4,895,326	270,842	269,243	113,857	155,386	2,330,823	2,311,372	19,451	16,442	7,927	8,515
Hardwood	600	..	600	..	52	..	52	34,000	..	34,000	1,976	..	1,976
Total	4,903,011	7,085	4,895,926	270,842	269,295	113,857	155,438	2,364,823	2,311,372	53,451	18,418	7,927	10,491
Northern Rocky Mountain:													
Softwood	1,964,810	..	1,964,810	8,525	295,275	82,600	212,675	1,046,188	909,914	136,274	21,414	1,479	19,935
Hardwood	185	..	185	..	1,688	..	1,688	22,245	..	22,245	3	..	3
Total	1,964,995	..	1,964,995	8,525	296,963	82,600	214,363	1,068,433	909,914	158,519	21,417	1,479	19,938
Southern Rocky Mountain:													
Softwood	555,333	..	555,333	..	14,502	..	14,502	673,444	277,864	395,580	7,972	2,502	5,470
Hardwood	665	..	665	..	..	..	..	187,042	..	187,042	998	..	998
Total	555,998	..	555,998	..	14,502	..	14,502	860,486	277,864	582,622	8,970	2,502	6,468
Total West:													
Softwood	19,877,351	30,195	19,847,156	1,509,121	4,477,890	1,372,014	3,105,876	16,756,930	15,519,634	1,237,296	133,879	28,220	105,659
Hardwood	22,649	..	22,649	..	49,911	300	49,611	250,949	..	250,949	3,090	..	3,090
Total	19,900,000	30,195	19,869,805	1,509,121	4,527,801	1,372,314	3,155,487	17,007,879	15,519,634	1,488,245	136,969	28,220	108,749
Continental United States:													
Softwood	31,433,231	30,195	31,403,036	1,548,198	21,407,807	1,399,686	20,008,121	31,011,584	24,879,312	6,132,272	362,109	35,983	326,126
Hardwood	8,003,126	..	8,003,126	919,113	3,657,126	168,070	3,489,056	27,535,159	6,454,091	21,081,068	395,820	23,351	372,469
Total	39,436,357	30,195	39,406,162	2,467,311	25,064,933	1,567,756	23,497,177	58,546,743	31,333,403	27,213,340	757,929	59,334	698,595
Coastal Alaska:													
Softwood	73,820	..	73,820	25	2,846	..	2,846	53,674	51,738	1,936	221	30	191
Hardwood	..	..	..	..	..	..	..	1,500	..	1,500	..	..	..
Total	73,820	..	73,820	25	2,846	..	2,846	55,174	51,738	3,436	221	30	191
All Regions:													
Softwood	31,507,051	30,195	31,476,856	1,548,223	21,410,653	1,399,686	20,010,967	31,065,258	24,931,050	6,134,208	362,330	36,013	326,317
Hardwood	8,003,126	..	8,003,126	919,113	3,657,126	168,070	3,489,056	27,536,659	6,454,091	21,082,568	395,820	23,351	372,469
Total	39,510,177	30,195	39,479,982	2,467,336	25,067,779	1,567,756	23,500,023	58,601,917	31,385,141	27,216,776	758,150	59,364	698,786

1/ Prepared by Forest Service, U. S. Department of Agriculture. Timber products output from roundwood is according to regions and sections where the logs, bolts, and other round timbers, cut for various products, originated and not necessarily where they were processed into lumber, pulp, veneer or other manufactured products or used in round form as poles, piling, posts, etc. The volume of plant residues such as used for fuelwood or chipped for pulp is, however, according to regions and sections where used. Volumes are in units of measure commonly used by the Bureau of the Census, the trade, or other agencies in reporting volume of output, i.e., sawlogs for lumber, timbers, sawn ties, etc., in board feet lumber tally; veneer logs and bolts, in board feet log scale; and pulpwood and fuelwood, in standard cords (128 cu. ft.) including bark. Volumes for all other products including cooperage logs and bolts, poles, and piling, posts, hewn ties, mine timbers and various miscellaneous products like box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, etc., are shown in cubic feet excluding bark. Except for a few posts and mine timbers within this group, plant residues are used exclusively for excelsior, chemical wood, and other such miscellaneous products.

Table 40.--Timber products output from roundwood in the United States and Coastal Alaska, by section, region of origin, and by softwoods and hardwoods, 1952[1]

Section, region, and species group	Total, all products	Sawlogs (for: lumber, etc.)	Veneer logs and bolts	Cooperage: logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round & split)	Hewn ties	Mine timbers (round)	Other[2]
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
North:												
New England:												
Softwood	348,981	183,695	(3/)	3,597	155,473	3,745	213	179	1,945	..	..	134
Hardwood	149,913	50,147	11,012	101	36,673	50,295	78	..	617	..	..	990
Total	498,894	233,842	11,012	3,698	192,146	54,040	291	179	2,562	..	..	1,124
Middle Atlantic:												
Softwood	140,558	81,720	133	..	48,420	5,239	2,494	76	1,726	..	55	695
Hardwood	401,852	179,155	6,663	1,343	37,746	118,961	1,283	..	14,994	..	33,911	7,796
Total	542,410	260,875	6,796	1,343	86,166	124,200	3,777	76	16,720	..	33,966	8,491
Lake States:												
Softwood	201,754	48,207	59	..	108,627	26,177	170	1,469	10,685	..	4,959	1,401
Hardwood	448,217	113,269	11,091	236	63,220	231,971	302	..	8,351	..	1,729	18,048
Total	649,971	161,476	11,150	236	171,847	258,148	472	1,469	19,036	..	6,688	19,449
Central:												
Softwood	17,518	12,040	57	..	322	55	..	64	4,672	..	..	308
Hardwood	458,772	165,840	9,209	16,852	7,690	205,847	159	..	24,652	1,337	18,155	9,031
Total	476,290	177,880	9,266	16,852	8,012	205,902	159	64	29,324	1,337	18,155	9,339
Plains:												
Softwood	9,711	1,790	..	..	578	1,201	..	20	6,122	..	..	..
Hardwood	114,512	6,673	957	..	..	89,455	..	16	16,990	..	..	421
Total	124,223	8,463	957	..	578	90,656	..	36	23,112	..	..	421
Total, North:												
Softwood	718,522	327,452	249	3,597	313,420	36,417	2,877	1,808	25,150	..	5,014	2,538
Hardwood	1,573,266	515,084	38,932	18,532	145,329	696,529	1,822	16	65,604	1,337	53,795	36,286
Total	2,291,788	842,536	39,181	22,129	458,749	732,946	4,699	1,824	90,754	1,337	58,809	38,824
South:												
South Atlantic:												
Softwood	936,651	486,866	2,902	4,921	218,694	190,326	3,235	6,398	10,474	839	1,023	10,973
Hardwood	565,203	224,622	46,156	533	44,013	212,765	222	..	11,487	2,558	5,535	17,312
Total	1,501,854	711,488	49,058	5,454	262,707	403,091	3,457	6,398	21,961	3,397	6,558	28,285
South East:												
Softwood	1,460,096	743,138	3,684	15,064	511,255	112,354	6,888	30,474	11,170	16,032	2,866	7,171
Hardwood	906,447	314,747	61,257	17,073	58,391	387,012	27	..	29,661	13,994	2,610	21,675
Total	2,366,543	1,057,885	64,941	32,137	569,646	499,366	6,915	30,474	40,831	30,026	5,476	28,846
West Gulf:												
Softwood	640,985	351,792	900	..	206,857	29,481	7,770	25,340	9,754	6,247	284	2,560
Hardwood	501,959	167,638	27,029	10,389	20,642	217,350	..	590	16,860	26,325	506	14,630
Total	1,142,944	519,430	27,929	10,389	227,499	246,831	7,770	25,930	26,614	32,572	790	17,190
Total, South:												
Softwood	3,037,732	1,581,796	7,486	19,985	936,806	332,161	17,893	62,212	31,398	23,118	4,173	20,704
Hardwood	1,973,609	707,007	134,442	27,995	123,046	817,127	249	590	58,008	42,877	8,651	53,617
Total	5,011,341	2,288,803	141,928	47,980	1,059,852	1,149,288	18,142	62,802	89,406	65,995	12,824	74,321
West:												
Pacific Northwest:												
Douglas-fir subregion:												
Softwood	2,177,818	1,602,403	200,955	2,231	259,399	49,708	4,234	9,952	1,357	..	154	47,425
Hardwood	8,029	2,971	..	..	4,263	682	..	..	53	..	..	60
Total	2,185,847	1,605,374	200,955	2,231	263,662	50,390	4,234	9,952	1,410	..	154	47,485
Pine subregion:												
Softwood	344,326	317,161	2,141	..	6,165	12,473	..	2,179	3,571	..	430	206
Hardwood	21	..	..	..	21	..	..	..	..	..	..	..
Total	344,347	317,161	2,141	..	6,186	12,473	..	2,179	3,571	..	430	206
Total, Pacific Northwest:												
Softwood	2,522,144	1,919,564	203,096	2,231	265,564	62,181	4,234	12,131	4,928	..	584	47,631
Hardwood	8,050	2,971	..	..	4,284	682	..	..	53	..	..	60
Total	2,530,194	1,922,535	203,096	2,231	269,848	62,863	4,234	12,131	4,981	..	584	47,691

Table 40.--Timber products output from roundwood in the United States and Coastal Alaska, by section, region of origin, and by softwoods and hardwoods, 1952[1] - Continued

Section, region, and species group	Total, all products	Sawlogs (for: lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round & split)	Hewn ties	Mine timbers (round)	Other[2]
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
West: - Continued												
California:												
Softwood	796,972	733,945	36,571	607	16,001	1,940	727	1,018	3,400	24	455	2,284
Hardwood	4,791	90	..	..	5	2,720	16	..	1,400	..	(3/)	560
Total	801,763	734,035	36,571	607	16,006	4,660	743	1,018	4,800	24	455	2,844
Northern Rocky Mountain:												
Softwood	313,189	264,124	1,352	..	17,029	10,749	10	8,179	2,885	..	6,374	2,487
Hardwood	1,928	31	..	..	135	1,759	..	..	1	..	2	..
Total	315,117	264,155	1,352	..	17,164	12,508	10	8,179	2,886	..	6,376	2,487
Southern Rocky Mountain:												
Softwood	122,543	83,769	..	..	1,305	31,999	5	1,669	1,216	..	1,908	672
Hardwood	14,344	110	..	..	..	13,236	..	5	21	..	4	968
Total	136,887	83,879	..	..	1,305	45,235	5	1,674	1,237	..	1,912	1,640
Total, West:												
Softwood	3,754,848	3,001,402	241,019	2,838	299,899	106,869	4,976	22,997	12,429	24	9,321	53,074
Hardwood	29,113	3,202	..	..	4,424	18,397	16	5	1,475	..	6	1,588
Total	3,783,961	3,004,604	241,019	2,838	304,323	125,266	4,992	23,002	13,904	24	9,327	54,662
Continental United States:												
Softwood	7,511,102	4,910,650	248,754	26,420	1,550,125	475,447	25,746	87,017	68,977	23,142	18,508	76,316
Hardwood	3,575,988	1,225,293	173,374	46,527	272,799	1,532,053	2,087	611	125,087	44,214	62,452	91,491
Total	11,087,090	6,135,943	422,128	72,947	1,822,924	2,007,500	27,833	87,628	194,064	67,356	80,960	167,807
Coastal Alaska:												
Softwood	10,616	10,020	4	..	221	180	166	9	16	..	..	..
Hardwood	135	..	..	..	..	135	..	..	..	..	..	..
Total	10,751	10,020	4	..	221	315	166	9	16	..	..	..
All regions:												
Softwood	7,521,718	4,920,670	248,758	26,420	1,550,346	475,627	25,912	87,026	68,993	23,142	18,508	76,316
Hardwood	3,576,123	1,225,293	173,374	46,527	272,799	1,532,188	2,087	611	125,087	44,214	62,452	91,491
Total	11,097,841	6,145,963	422,132	72,947	1,823,145	2,007,815	27,999	87,637	194,080	67,356	80,960	167,807

1/ Prepared by Forest Service, U. S. Department of Agriculture. Output from roundwood is according to regions and sections where the logs, bolts, and other round timbers, cut for various products, originated and not necessarily where they were processed into lumber, veneer, pulp or other manufactured products or used in round form as poles, piling, posts, etc. Volumes are in cubic feet roundwood excluding bark.

2/ Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and bolts for other such miscellaneous products.

3/ Less than 0.5 thousand cubic feet.

Table 41.--Timber products output from growing stock on commercial forest land in the United States and Coastal Alaska, by section, region of origin, and by softwoods and hardwoods, 1952[1/]

Section, region, and species group	Total, all products	Sawlogs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round & split)	Hewn ties	Mine timbers (round)	Other[2/]
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
North:												
New England:												
Softwood	331,050	174,254	..	3,471	148,777	2,213	213	179	1,816	..	..	127
Hardwood	123,878	47,679	10,991	98	34,730	28,783	78	..	567	..	..	952
Total	454,928	221,933	10,991	3,569	183,507	30,996	291	179	2,383	..	..	1,079
Middle Atlantic:												
Softwood	118,149	76,084	132	..	35,388	2,120	2,482	76	1,137	..	49	681
Hardwood	293,327	168,938	6,592	1,325	34,644	34,895	1,280	..	11,479	..	27,438	6,736
Total	411,476	245,022	6,724	1,325	70,032	37,015	3,762	76	12,616	..	27,487	7,417
Lake States:												
Softwood	169,703	47,482	59	..	100,787	6,584	170	1,469	7,868	..	3,919	1,365
Hardwood	304,379	110,348	11,088	236	62,581	97,076	302	..	6,686	..	1,554	14,508
Total	474,082	157,830	11,147	236	163,368	103,660	472	1,469	14,554	..	5,473	15,873
Central:												
Softwood	16,867	12,040	57	..	322	55	..	64	4,188	..	..	141
Hardwood	345,147	165,840	9,209	16,852	7,482	102,800	159	..	16,717	1,337	18,155	6,596
Total	362,014	177,880	9,266	16,852	7,804	102,855	159	64	20,905	1,337	18,155	6,737
Plains:												
Softwood	3,702	1,780	..	..	488	146	..	17	1,271	..	..	..
Hardwood	20,975	6,573	956	..	..	9,728	..	..	3,639	..	..	79
Total	24,677	8,353	956	..	488	9,874	..	17	4,910	..	..	79
Total, North:												
Softwood	639,471	311,640	248	3,471	285,762	11,118	2,865	1,805	16,280	..	3,968	2,314
Hardwood	1,087,706	499,378	38,836	18,511	139,437	273,282	1,819	..	39,088	1,337	47,147	28,871
Total	1,727,177	811,018	39,084	21,982	425,199	284,400	4,684	1,805	55,368	1,337	51,115	31,185
South:												
South Atlantic:												
Softwood	838,201	485,063	2,902	4,921	206,267	110,692	3,235	6,398	6,535	818	1,023	10,347
Hardwood	424,285	222,285	46,156	533	37,981	89,214	222	..	7,168	2,492	5,292	12,942
Total	1,262,486	707,348	49,058	5,454	244,248	199,906	3,457	6,398	13,703	3,310	6,315	23,289
Southeast:												
Softwood	1,356,194	739,607	3,684	14,937	459,294	68,768	6,888	30,474	7,137	15,660	2,866	6,879
Hardwood	720,748	309,471	61,114	17,003	48,514	227,999	27	..	21,584	13,867	2,610	18,559
Total	2,076,942	1,049,078	64,798	31,940	507,808	296,767	6,915	30,474	28,721	29,527	5,476	25,438
West Gulf:												
Softwood	596,464	349,698	900	..	174,586	20,440	7,770	25,340	8,779	6,247	284	2,420
Hardwood	411,856	164,455	26,884	10,271	18,180	141,278	..	590	12,645	26,137	506	10,910
Total	1,008,320	514,153	27,784	10,271	192,766	161,718	7,770	25,930	21,424	32,384	790	13,330
Total, South:												
Softwood	2,790,859	1,574,368	7,486	19,858	840,147	199,900	17,893	62,212	22,451	22,725	4,173	19,646
Hardwood	1,556,889	696,211	134,154	27,807	104,675	458,491	249	590	41,397	42,496	8,408	42,411
Total	4,347,748	2,270,579	141,640	47,665	944,822	658,391	18,142	62,802	63,848	65,221	12,581	62,057
West:												
Pacific Northwest:												
Douglas-fir subregion:												
Softwood	1,830,807	1,352,524	171,202	1,674	249,857	14,282	4,234	9,952	935	..	154	25,993
Hardwood	7,891	2,868	..	..	4,244	682	..	..	37	..	..	60
Total	1,838,698	1,355,392	171,202	1,674	254,101	14,964	4,234	9,952	972	..	154	26,053
Pine subregion:												
Softwood	320,645	304,354	2,141	..	6,066	3,143	..	2,179	2,175	..	422	165
Hardwood	20	..	..	..	20	..	..	..	..	..	..	..
Total	320,665	304,354	2,141	..	6,086	3,143	..	2,179	2,175	..	422	165
Total, Pacific Northwest:												
Softwood	2,151,452	1,656,878	173,343	1,674	255,923	17,425	4,234	12,131	3,110	..	576	26,158
Hardwood	7,911	2,868	..	..	4,264	682	..	..	37	..	..	60
Total	2,159,363	1,659,746	173,343	1,674	260,187	18,107	4,234	12,131	3,147	..	576	26,218

Table 41.--Timber products output from growing stock on commercial forest land in the United States and Coastal Alaska, by section, region of origin, and by softwoods and hardwoods, 1952[1/] - Continued

Section, region, and species group	Total, all products	Sawlogs (for: lumber, etc.)	Veneer logs and bolts	Cooperage: logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round & split)	Hewn ties	Mine timbers (round)	Other[2/]
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
West - Continued												
California:												
Softwood	764,755	711,703	36,509	607	9,025	540	727	1,018	2,400	22	410	1,794
Hardwood	75	15	..	..	..	60	..	..	..	..	(3/)	..
Total	764,830	711,718	36,509	607	9,025	600	727	1,018	2,400	22	410	1,794
Northern Rocky Mountain:												
Softwood	294,775	256,586	1,352	..	16,116	2,222	10	8,179	2,161	..	5,808	2,341
Hardwood	1,236	31	..	..	116	1,089	..	..	..	..	(3/)	..
Total	296,011	256,617	1,352	..	16,232	3,311	10	8,179	2,161	..	5,808	2,341
Southern Rocky Mountain:												
Softwood	85,966	81,118	..	..	..	487	5	1,667	380	..	1,639	670
Hardwood	1,261	110	..	..	..	183	..	..	..	..	..	968
Total	87,227	81,228	..	..	..	670	5	1,667	380	..	1,639	1,638
Total, West:												
Softwood	3,296,948	2,706,285	211,204	2,281	281,064	20,674	4,976	22,995	8,051	22	8,433	30,963
Hardwood	10,483	3,024	..	..	4,380	2,014	..	..	37	..	(3/)	1,028
Total	3,307,431	2,709,309	211,204	2,281	285,444	22,688	4,976	22,995	8,088	22	8,433	31,991
Continental United States:												
Softwood	6,727,278	4,592,293	218,938	25,610	1,406,973	231,692	25,734	87,012	46,782	22,747	16,574	52,923
Hardwood	2,655,078	1,198,613	172,990	46,318	248,492	733,787	2,068	590	80,522	43,833	55,555	72,310
Total	9,382,356	5,790,906	391,928	71,928	1,655,465	965,479	27,802	87,602	127,304	66,580	72,129	125,233
Coastal Alaska:												
Softwood	10,244	9,820	4	..	221	20	166	9	4	..	...	..
Hardwood	..	..	..	..	..	..	..	..	..	..	..	..
Total	10,244	9,820	4	..	221	20	166	9	4	..	..	..
All regions:												
Softwood	6,737,522	4,602,113	218,942	25,610	1,407,194	231,712	25,900	87,021	46,786	22,747	16,574	52,923
Hardwood	2,655,078	1,198,613	172,990	46,318	248,492	733,787	2,068	590	80,522	43,833	55,555	72,310
Total	9,392,600	5,800,726	391,932	71,928	1,655,686	965,499	27,968	87,611	127,308	66,580	72,129	125,233

1/ Prepared by Forest Service, U. S. Department of Agriculture. Output from growing stock is according to regions and sections where the logs, bolts, and other round timbers, cut for various products, originated and not necessarily where they were processed into lumber, veneer, pulp, or other manufactured products or used in round form as poles, piling, posts, etc. Volumes are in cubic feet roundwood excluding bark.

2/ Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and other such miscellaneous products.

3/ Less than 0.5 thousand cubic feet.

Table 42.--Timber cut on commercial forest land in the United States and Coastal Alaska, by product, and by class of material, 1952[1]

Product	Growing stock			Sawtimber						Poletimber		
	Total cut	Timber products	Logging residues	Total cut		Timber products		Logging residues		Total cut	Timber products	Logging residues
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
Sawlogs (for lumber, timbers, sawn ties, etc.)	6,820,453	5,800,726	1,019,727	6,565,205	36,636,198	5,623,774	34,534,208	941,431	2,101,990	255,248	176,952	78,296
Veneer logs and bolts	491,648	391,932	99,716	488,234	2,803,121	390,649	2,562,044	97,585	241,077	3,414	1,283	2,131
Cooperage logs and bolts	104,718	71,928	32,790	102,367	516,302	70,016	447,905	32,351	68,397	2,351	1,912	439
Pulpwood	1,727,498	1,655,686	71,812	974,890	4,693,265	921,668	4,607,469	53,222	85,796	752,608	734,018	18,590
Fuelwood	1,004,279	965,499	38,780	537,853	2,245,784	500,406	2,217,837	37,447	27,947	466,426	465,093	1,333
Piling	32,322	27,968	4,354	31,274	159,140	26,993	151,195	4,281	7,945	1,048	975	73
Poles	101,405	87,611	13,794	91,657	469,562	78,738	447,929	12,919	21,633	9,748	8,873	875
Posts (round and split)	131,290	127,308	3,982	43,959	217,528	41,296	211,147	2,663	6,381	87,331	86,012	1,319
Hewn ties	108,536	66,580	41,956	106,171	483,021	65,481	399,077	40,690	83,944	2,365	1,099	1,266
Mine timbers (round)	77,083	72,129	4,954	22,975	100,104	20,579	97,241	2,396	2,863	54,108	51,550	2,558
Other[2]	157,541	125,233	32,308	103,822	515,804	76,731	451,846	27,091	63,958	53,719	48,502	5,217
Total	10,756,773	9,392,600	1,364,173	9,068,407	48,839,829	7,816,331	46,127,898	1,252,076	2,711,931	1,688,366	1,576,269	112,097

1/ Prepared by Forest Service, U. S. Department of Agriculture. Volumes refer to growing stock inventory and are in cubic feet roundwood excluding bark and in board feet log scale, International 1/4-inch rule, and represent the net cubic-foot volume of live sawtimber and poletimber trees from stump to minimum 4.0-inch top (of central stem) inside bark and the net board-foot volume of the sawlog portion of live sawtimber trees (from stump to merchantable top) cut or killed in logging and converted to timber products or left as logging residues.

2/ Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and other such products.

Table 43.--Timber cut for all products on commercial forest land in the United States and Coastal Alaska, by class of material, and by section and region of origin, 1952 [1]

Section and region	Growing stock			Sawtimber						Poletimber		
	Total cut	Timber products	Logging residues	Total cut		Timber products		Logging residues		Total cut	Timber products	Logging residues
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
North:												
New England	500,218	454,928	45,290	385,742	1,768,456	351,115	1,669,111	34,627	99,345	114,476	103,813	10,663
Middle Atlantic	469,299	411,476	57,823	362,753	1,794,916	314,076	1,669,396	48,677	125,520	106,546	97,400	9,146
Lake States	537,170	474,082	63,088	266,389	1,240,407	227,709	1,187,417	38,680	52,990	270,781	246,373	24,408
Central	405,142	362,014	43,128	292,977	1,808,970	250,622	1,651,730	42,355	157,240	112,165	111,392	773
Plains	28,104	24,677	3,427	18,376	93,532	15,166	88,738	3,210	4,794	9,728	9,511	217
Total	1,939,933	1,727,177	212,756	1,326,237	6,706,281	1,158,688	6,266,392	167,549	439,889	613,696	568,489	45,207
South:												
South Atlantic	1,454,948	1,262,486	192,462	1,148,291	5,352,165	971,827	5,140,460	176,464	211,705	306,657	290,659	15,998
Southeast	2,405,459	2,076,942	328,517	1,928,963	9,411,186	1,623,065	9,068,966	305,898	342,220	476,496	453,877	22,619
West Gulf	1,192,846	1,008,320	184,526	963,319	4,835,211	788,400	4,613,860	174,919	221,351	229,527	219,920	9,607
Total	5,053,253	4,347,748	705,505	4,040,573	19,598,562	3,383,292	18,823,286	657,281	775,276	1,012,680	964,456	48,224
West:												
Pacific Northwest:												
Douglas-fir subregion	2,031,275	1,838,698	192,577	2,017,837	12,220,815	1,826,571	11,370,748	191,266	850,067	13,438	12,127	1,311
Pine subregion	359,271	320,665	38,606	356,071	2,049,861	317,808	1,942,519	38,263	107,342	3,200	2,857	343
Total	2,390,546	2,159,363	231,183	2,373,908	14,270,676	2,144,379	13,313,267	229,529	957,409	16,638	14,984	1,654
California	931,536	764,830	166,706	923,881	5,724,198	764,670	5,262,363	159,211	461,835	7,655	160	7,495
Northern Rocky Mountain	329,093	296,011	33,082	301,915	1,899,016	275,084	1,858,389	26,831	40,627	27,178	20,927	6,251
Southern Rocky Mountain	100,040	87,227	12,813	89,737	555,004	79,986	526,587	9,751	28,417	10,303	7,241	3,062
Total	3,751,215	3,307,431	443,784	3,689,441	22,448,894	3,264,119	20,960,606	425,322	1,488,288	61,774	43,312	18,462
Continental United States	10,744,401	9,382,356	1,362,045	9,056,251	48,753,737	7,806,099	46,050,284	1,250,152	2,703,453	1,688,150	1,576,257	111,893
Coastal Alaska	12,372	10,244	2,128	12,156	86,092	10,232	77,614	1,924	8,478	216	12	204
All Regions	10,756,773	9,392,600	1,364,173	9,068,407	48,839,829	7,816,331	46,127,898	1,252,076	2,711,931	1,688,366	1,576,269	112,097

1/ Prepared by Forest Service, U. S. Department of Agriculture. Volumes refer to growing stock inventory and are in cubic feet roundwood excluding bark and in board feet log scale, International 1/4-inch rule, and represent the net cubic-foot volume of live sawtimber and poletimber trees from stump to minimum 4.0-inch top (of central stem) inside bark and the net board-foot volume of the sawlog portion of live sawtimber trees (from stump to merchantable top) cut or killed in logging and converted to timber products or left as logging residues.

Table 44.--Timber cut for all products from live sawtimber and growing stock on commercial forest land in the United States and Coastal Alaska, by section and region of origin, and by softwoods and hardwoods, 1952[1/]

Section and region	Growing stock			Live sawtimber					
	Total	Softwood	Hardwood	Total		Softwood		Hardwood	
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand cu. ft.	Thousand bd. ft.
North:									
New England	500,218	361,082	139,136	385,742	1,768,456	306,677	1,380,918	79,065	387,538
Middle Atlantic	469,299	129,504	339,795	362,753	1,794,916	107,816	507,531	254,937	1,287,385
Lake States	537,170	188,566	348,604	266,389	1,240,407	82,937	383,959	183,452	856,448
Central	405,142	16,911	388,231	292,977	1,808,970	13,030	85,456	279,947	1,723,514
Plains	28,104	3,960	24,144	18,376	93,532	2,303	12,239	16,073	81,293
Total	1,939,933	700,023	1,239,910	1,326,237	6,706,281	512,763	2,370,103	813,474	4,336,178
South:									
South Atlantic	1,454,948	915,856	539,092	1,148,291	5,352,165	710,652	3,359,933	437,639	1,992,232
Southeast	2,405,459	1,479,153	926,306	1,928,963	9,411,186	1,152,356	5,724,120	776,607	3,687,066
West Gulf	1,192,846	651,101	541,745	963,319	4,835,211	501,938	2,636,377	461,381	2,198,834
Total	5,053,253	3,046,110	2,007,143	4,040,573	19,598,562	2,364,946	11,720,430	1,675,627	7,878,132
West:									
Pacific Northwest:									
Douglas-fir subregion	2,031,275	2,022,525	8,750	2,017,837	12,220,815	2,009,266	12,169,523	8,571	51,292
Pine subregion	359,271	359,249	22	356,071	2,049,861	356,049	2,049,718	22	143
Total	2,390,546	2,381,774	8,772	2,373,908	14,270,676	2,365,315	14,219,241	8,593	51,435
California	931,536	920,389	11,147	923,881	5,724,198	915,314	5,704,180	8,567	20,018
Northern Rocky Mountain	329,093	327,836	1,257	301,915	1,899,016	301,531	1,896,823	384	2,193
Southern Rocky Mountain	100,040	98,587	1,453	89,737	555,004	88,647	548,993	1,090	6,011
Total	3,751,215	3,728,586	22,629	3,689,441	22,448,894	3,670,807	22,369,237	18,634	79,657
Continental United States	10,744,401	7,474,719	3,269,682	9,056,251	48,753,737	6,548,516	36,459,770	2,507,735	12,293,967
Coastal Alaska	12,372	12,372	..	12,156	86,092	12,156	86,092	..	..
All regions	10,756,773	7,487,091	3,269,682	9,068,407	48,839,829	6,560,672	36,545,862	2,507,735	12,293,967

1/ Prepared by Forest Service, U. S. Department of Agriculture. Estimates of timber cut include logging residues as well as growing stock material removed as timber products. Volumes refer to growing stock inventory and are in cubic feet roundwood excluding bark and in board feet log scale, International 1/4-inch rule and represent the net cubic foot volume of live sawtimber and poletimber trees from stump to minimum 4.0-inch top (of central stem) inside bark and the net board foot volume of the sawlog portion of live sawtimber trees (from stump to merchantable top) cut or killed in logging.

Table 45.--Timber cut from live sawtimber and growing stock on commercial forest land in the United States and Coastal Alaska, by product and by softwoods and hardwoods, 1952 [1/]

(Comparable to Table 9, Basic Forest Statistics for the United States, January 1945, revised September 1950)

Product	Growing stock			Live sawtimber					
	Total	Softwood	Hardwood	Total		Softwood		Hardwood	
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand cu. ft.	Thousand bd. ft.
Sawlogs (for lumber, timbers, sawn ties, etc.)	6,820,453	5,213,623	1,606,830	6,565,205	36,636,198	5,055,696	28,890,540	1,509,509	7,745,658
Veneer logs and bolts	491,648	250,428	241,220	488,234	2,803,121	250,125	1,575,655	238,109	1,227,466
Cooperage logs and bolts	104,718	28,944	75,774	102,367	516,302	27,029	143,276	75,338	373,026
Pulpwood	1,727,498	1,460,057	267,441	974,890	4,693,265	871,277	4,251,775	103,613	441,490
Fuelwood	1,004,279	243,541	760,738	537,853	2,245,784	143,888	595,211	393,965	1,650,573
Piling	32,322	29,885	2,437	31,274	159,140	28,861	147,665	2,413	11,475
Poles	101,405	100,805	600	91,657	469,562	91,059	465,774	598	3,788
Posts (round and split)	131,290	49,581	81,709	43,959	217,528	14,667	68,771	29,292	148,757
Hewn ties	108,536	31,789	76,747	106,171	483,021	31,684	151,781	74,487	331,240
Mine timbers (round)	77,083	18,904	58,179	22,975	100,104	8,550	40,733	14,425	59,371
Other [2/]	157,541	59,534	98,007	103,822	515,804	37,836	214,681	65,986	301,123
Total	10,756,773	7,487,091	3,269,682	9,068,407	48,839,829	6,560,672	36,545,862	2,507,735	12,293,967

1/ Prepared by Forest Service, U. S. Department of Agriculture. Estimates of timber cut include logging residues as well as growing stock material removed as timber products. Volumes refer to growing stock inventory and are in cubic feet roundwood excluding bark and in board feet log scale International 1/4-inch rule and represent the net cubic foot volume of live sawtimber and poletimber trees from stump to minimum 4.0 inch top (of central stem) inside bark and the net board foot volume of the sawlog portion of live sawtimber trees (from stump to merchantable top) cut or killed in logging.

2/ Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood and other such miscellaneous products.

Table 46.--Timber cut from live sawtimber on commercial forest land in the United States and Coastal Alaska, by product, and by section, region of origin, and by softwoods and hardwoods, 1952[1/]

VOLUME IN BOARD FEET[2/]

Section, region, and species group	Total all products	Sawlogs (for lumber, etc.)	Veneer logs and bolts	Cooperage, logs, and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other[3/]
	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.
North:												
New England:												
Softwood	1,380,918	835,737	..	8,646	531,150	2,450	1,045	771	513	..	..	606
Hardwood	387,538	222,834	69,554	338	76,036	13,531	380	..	64	..	..	4,801
Total	1,768,456	1,058,571	69,554	8,984	607,186	15,981	1,425	771	577	..	..	5,407
Middle Atlantic:												
Softwood	507,531	393,313	873	..	93,456	5,396	12,365	340	575	..	45	1,168
Hardwood	1,287,385	1,003,490	43,409	8,818	66,503	70,520	6,508	..	18,616	..	41,886	27,635
Total	1,794,916	1,396,803	44,282	8,818	159,959	75,916	18,873	340	19,191	..	41,931	28,803
Lake States:												
Softwood	383,959	249,167	403	..	97,684	5,520	1,330	4,666	8,746	..	11,407	5,036
Hardwood	856,448	593,142	81,012	1,721	30,156	96,795	2,370	..	6,840	..	7,430	36,982
Total	1,240,407	842,309	81,415	1,721	127,840	102,315	3,700	4,666	15,586	..	18,837	42,018
Central:												
Softwood	85,456	77,696	390	..	128	130	..	285	6,827	..	..	..
Hardwood	1,723,514	1,246,062	69,844	122,858	4,676	213,463	958	..	29,730	9,108	..	26,815
Total	1,808,970	1,323,758	70,234	122,858	4,804	213,593	958	285	36,557	9,108	..	26,815
Plains:												
Softwood	12,239	10,455	..	..	689	861	..	..	234	..	..	..
Hardwood	81,293	45,586	7,306	..	..	21,872	..	..	6,338	..	..	191
Total	93,532	56,041	7,306	..	689	22,733	..	..	6,572	..	..	191
Total North:												
Softwood	2,370,103	1,566,368	1,666	8,646	723,107	14,357	14,740	6,062	16,895	..	11,452	6,810
Hardwood	4,336,178	3,111,114	271,125	133,735	177,371	416,181	10,216	..	61,588	9,108	49,316	96,424
Total	6,706,281	4,677,482	272,791	142,381	900,478	430,538	24,956	6,062	78,483	9,108	60,768	103,234
South:												
South Atlantic:												
Softwood	3,359,933	2,587,600	16,871	29,171	520,364	121,121	15,653	31,579	6,408	5,161	1,841	24,164
Hardwood	1,992,232	1,486,772	304,305	3,803	72,400	39,651	1,074	..	7,028	16,684	10,054	50,461
Total	5,352,165	4,074,372	321,176	32,974	592,764	160,772	16,727	31,579	13,436	21,845	11,895	74,625
Southeast:												
Softwood	5,724,120	4,114,283	21,038	88,054	942,348	235,026	38,546	166,117	3,055	100,186	3,687	11,780
Hardwood	3,687,066	2,036,884	438,315	138,451	117,003	707,184	174	..	48,720	104,995	..	95,340
Total	9,411,186	6,151,167	459,353	226,505	1,059,351	942,210	38,720	166,117	51,775	205,181	3,687	107,120
West Gulf:												
Softwood	2,636,377	2,036,922	4,985	..	246,690	107,577	44,512	145,166	1,274	46,186	365	2,700
Hardwood	2,198,834	1,076,227	213,199	97,033	45,347	481,533	..	3,776	31,098	200,452	..	50,169
Total	4,835,211	3,113,149	218,184	97,033	292,037	589,110	44,512	148,942	32,372	246,638	365	52,869
Total South:												
Softwood	11,720,430	8,738,805	42,894	117,225	1,709,402	463,724	98,711	342,862	10,737	151,533	5,893	38,644
Hardwood	7,878,132	4,599,883	955,819	239,287	234,750	1,228,368	1,248	3,776	86,846	322,131	10,054	195,970
Total	19,598,562	13,338,688	998,713	356,512	1,944,152	1,692,092	99,959	346,638	97,583	473,664	15,947	234,614

See footnotes at end of table.

Table 46.--Timber cut from live sawtimber on commercial forest land in the United States and Coastal Alaska, by product, and by section, region of origin, and by softwoods and hardwoods, 1952[1]--Continued

VOLUME IN BOARD FEET[2]--Continued

Section, region, and species group	Total all products	Sawlogs (for lumber, etc.)	Veneer logs and bolts	Cooperage, logs, and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other[3]
	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.
West:												
Pacific Northwest:												
Douglas-fir subregion												
Softwood	12,169,523	8,971,166	1,176,240	11,683	1,667,305	88,548	29,335	66,028	5,979	..	880	152,359
Hardwood	51,292	18,660	..	..	28,092	3,903	..	..	230	..	..	407
Total	12,220,815	8,989,826	1,176,240	11,683	1,695,397	92,451	29,335	66,028	6,209	..	880	152,766
Pine subregion:												
Softwood	2,049,718	1,957,740	14,368	..	37,780	16,974	..	8,447	11,704	..	2,324	381
Hardwood	143	..	..	..	143	..	..	..	..	..	..	..
Total	2,049,861	1,957,740	14,368	..	37,923	16,974	..	8,447	11,704	..	2,324	381
Total Pacific Northwest:												
Softwood	14,219,241	10,928,906	1,190,608	11,683	1,705,085	105,522	29,335	74,475	17,683	..	3,204	152,740
Hardwood	51,435	18,660	..	..	28,235	3,903	..	..	230	..	..	407
Total	14,270,676	10,947,566	1,190,608	11,683	1,733,320	109,425	29,335	74,475	17,913	..	3,204	153,147
California:												
Softwood	5,704,180	5,266,878	331,659	5,722	53,574	3,000	3,702	4,685	18,224	248	1,516	14,972
Hardwood	20,018	15,104	522	4	340	188	11	12	93	1	1	3,742
Total	5,724,198	5,281,982	332,181	5,726	53,914	3,188	3,713	4,697	18,317	249	1,517	18,714
Northern Rocky Mountain:												
Softwood	1,896,823	1,770,653	8,797	..	58,774	6,852	..	30,350	4,315	..	16,444	638
Hardwood	2,193	201	..	..	794	1,198	..	..	..	..	..	..
Total	1,899,016	1,770,854	8,797	..	59,568	8,050	..	30,350	4,315	..	16,444	638
Southern Rocky Mountain:												
Softwood	548,993	536,006	..	..	..	1,673	..	7,308	905	..	2,224	877
Hardwood	6,011	696	..	..	..	735	..	..	..	..	..	4,580
Total	555,004	536,702	..	..	..	2,408	..	7,308	905	..	2,224	5,457
Total West:												
Softwood	22,369,237	18,502,443	1,531,064	17,405	1,817,433	117,047	33,037	116,818	41,127	248	23,388	169,227
Hardwood	79,657	34,661	522	4	29,369	6,024	11	12	323	1	1	8,729
Total	22,448,894	18,537,104	1,531,586	17,409	1,846,802	123,071	33,048	116,830	41,450	249	23,389	177,956
Continental United States:												
Softwood	36,459,770	28,807,616	1,575,624	143,276	4,249,942	595,128	146,488	465,742	68,759	151,781	40,733	214,681
Hardwood	12,293,967	7,745,658	1,227,466	373,026	441,490	1,650,573	11,475	3,788	148,757	331,240	59,371	301,123
Total	48,753,737	36,553,274	2,803,090	516,302	4,691,432	2,245,701	157,963	469,530	217,516	483,021	100,104	515,804
Coastal Alaska:												
Softwood	86,092	82,924	31	..	1,833	83	1,177	32	12	..	..	..
Hardwood	..	..	..	..	..	..	..	..	..	..	..	..
Total	86,092	82,924	31	..	1,833	83	1,177	32	12	..	..	..
All Regions:												
Softwood	36,545,862	28,890,540	1,575,655	143,276	4,251,775	595,211	147,665	465,774	68,771	151,781	40,733	214,681
Hardwood	12,293,967	7,745,658	1,227,466	373,026	441,490	1,650,573	11,475	3,788	148,757	331,240	59,371	301,123
Total	48,839,829	36,636,198	2,803,121	516,302	4,693,265	2,245,784	159,140	469,562	217,528	483,021	100,104	515,804

See footnotes at end of table.

Table 46.--Timber cut from live sawtimber on commercial forest land in the United States and Coastal Alaska, by product, and by section, region of origin, and softwoods and hardwoods, 1952[1]--Continued

VOLUME IN CUBIC FEET[4]

Section, region, and species group	Total all products	Sawlogs (for lumber, etc.)	Veneer logs and bolts	Cooperage, logs, and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other[3]
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
North:												
New England:												
Softwood	306,677	186,451	..	2,177	116,807	582	223	174	131	..	..	132
Hardwood	79,065	44,240	13,164	68	17,260	3,219	83	..	15	..	..	1,016
Total	385,742	230,691	13,164	2,245	134,067	3,801	306	174	146	..	..	1,148
Middle Atlantic:												
Softwood	107,816	80,697	160	..	22,496	1,248	2,710	79	146	..	11	269
Hardwood	254,937	192,170	8,208	1,785	15,694	16,027	1,485	..	4,134	..	9,892	5,542
Total	362,753	272,867	8,368	1,785	38,190	17,275	4,195	79	4,280	..	9,903	5,811
Lake States:												
Softwood	82,937	47,131	73	..	24,215	2,854	230	1,019	3,109	..	3,175	1,131
Hardwood	183,452	109,975	13,932	298	8,377	37,642	404	..	2,354	..	1,674	8,796
Total	266,389	157,106	14,005	298	32,592	40,496	634	1,019	5,463	..	4,849	9,927
Central:												
Softwood	13,030	11,774	57	..	20	20	..	49	1,110	..	..	..
Hardwood	279,947	198,729	11,298	20,259	850	37,327	168	..	5,198	1,645	..	4,473
Total	292,977	210,503	11,355	20,259	870	37,347	168	49	6,308	1,645	..	4,473
Plains:												
Softwood	2,303	1,890	..	..	168	143	..	..	102	..	..	..
Hardwood	16,073	8,721	1,290	..	..	4,621	..	..	1,392	..	..	49
Total	18,376	10,611	1,290	..	168	4,764	..	..	1,494	..	..	49
Total North:												
Softwood	512,763	327,943	290	2,177	163,706	4,847	3,163	1,321	4,598	..	3,186	1,532
Hardwood	813,474	553,835	47,892	22,410	42,181	98,836	2,140	..	13,093	1,645	11,566	19,876
Total	1,326,237	881,778	48,182	24,587	205,887	103,683	5,303	1,321	17,691	1,645	14,752	21,408
South:												
South Atlantic:												
Softwood	710,652	514,214	3,919	5,714	123,196	44,748	3,482	7,017	1,561	1,152	574	5,075
Hardwood	437,639	299,399	64,932	862	18,101	35,289	239	..	1,713	4,032	2,858	10,214
Total	1,148,291	813,613	68,851	6,576	141,297	80,037	3,721	7,017	3,274	5,184	3,432	15,289
Southeast:												
Softwood	1,152,356	785,572	4,423	16,471	225,025	52,953	7,747	34,150	888	21,999	645	2,483
Hardwood	776,607	421,291	86,629	29,494	27,691	157,005	27	..	8,865	23,757	..	21,848
Total	1,928,963	1,206,863	91,052	45,965	252,716	209,958	7,774	34,150	9,753	45,756	645	24,331
West Gulf:												
Softwood	501,938	372,253	902	..	60,128	21,319	8,807	28,724	594	8,505	63	643
Hardwood	461,381	224,712	38,455	22,571	10,656	101,791	..	590	5,538	45,053	..	12,015
Total	963,319	596,965	39,357	22,571	70,784	123,110	8,807	29,314	6,132	53,558	63	12,658
Total South:												
Softwood	2,364,946	1,672,039	9,244	22,185	408,349	119,020	20,036	69,891	3,043	31,656	1,282	8,201
Hardwood	1,675,627	945,402	190,016	52,927	56,448	294,085	266	590	16,116	72,842	2,858	44,077
Total	4,040,573	2,617,441	199,260	75,112	464,797	413,105	20,302	70,481	19,159	104,498	4,140	52,278

See footnotes at end of table.

Table 46.--Timber cut from live sawtimber on commercial forest land in the United States and Coastal Alaska, by product, and by section, region of origin, and softwoods and hardwoods, 1952[1]--Continued

VOLUME IN CUBIC FEET[4]--Continued

Section, region, and species group	Total all products	Sawlogs (for lumber, etc.)	Veneer logs and bolts	Cooperage, logs, and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other[3]
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
West:												
Pacific Northwest:												
Douglas-fir subregion:												
Softwood	2,009,266	1,488,895	188,958	1,842	272,800	14,945	4,676	10,515	997	..	147	25,491
Hardwood	8,571	3,176	..	..	4,640	652	..	..	37	..	..	66
Total	2,017,837	1,492,071	188,958	1,842	277,440	15,597	4,676	10,515	1,034	..	147	25,557
Pine subregion:												
Softwood	356,049	340,637	2,398	..	6,193	2,954	..	1,381	2,037	..	383	66
Hardwood	22	..	..	..	22	..	..	..	..	..	..	..
Total	356,071	340,637	2,398	..	6,215	2,954	..	1,381	2,037	..	383	66
Total Pacific Northwest:												
Softwood	2,365,315	1,829,532	191,356	1,842	278,993	17,899	4,676	11,896	3,034	..	530	25,557
Hardwood	8,593	3,176	..	..	4,662	652	..	..	37	..	..	66
Total	2,373,908	1,832,708	191,356	1,842	283,655	18,551	4,676	11,896	3,071	..	530	25,623
California:												
Softwood	915,314	848,585	47,765	825	9,915	540	809	1,109	3,094	28	340	2,304
Hardwood	8,567	6,944	201	1	195	30	7	8	46	(5/)	1	1,134
Total	923,881	855,529	47,966	826	10,110	570	816	1,117	3,140	28	341	3,438
Northern Rocky Mountain:												
Softwood	301,531	279,552	1,466	..	10,051	1,257	..	5,544	737	..	2,831	93
Hardwood	384	33	..	..	127	224	..	..	..	..	..	..
Total	301,915	279,585	1,466	..	10,178	1,481	..	5,544	737	..	2,831	93
Southern Rocky Mountain:												
Softwood	88,647	86,355	..	..	..	310	..	1,293	159	..	381	149
Hardwood	1,090	119	..	..	..	138	..	..	..	..	..	833
Total	89,737	86,474	..	..	..	448	..	1,293	159	..	381	982
Total West:												
Softwood	3,670,807	3,044,024	240,587	2,667	298,959	20,006	5,485	19,842	7,024	28	4,082	28,103
Hardwood	18,634	10,272	201	1	4,984	1,044	7	8	83	(5/)	1	2,033
Total	3,689,441	3,054,296	240,788	2,668	303,943	21,050	5,492	19,850	7,107	28	4,083	30,136
Continental United States:												
Softwood	6,548,516	5,044,006	250,121	27,029	871,014	143,873	28,684	91,054	14,665	31,684	8,550	37,836
Hardwood	2,507,735	1,509,509	238,109	75,338	103,613	393,965	2,413	598	29,292	74,487	14,425	65,986
Total	9,056,251	6,553,515	488,230	102,367	974,627	537,838	31,097	91,652	43,957	106,171	22,975	103,822
Coastal Alaska:												
Softwood	12,156	11,690	4	..	263	15	177	5	2	..	..	..
Hardwood	..	..	..	..	..	..	..	..	..	..	..	..
Total	12,156	11,690	4	..	263	15	177	5	2	..	..	..
All Regions:												
Softwood	6,560,672	5,055,696	250,125	27,029	871,277	143,888	28,861	91,059	14,667	31,684	8,550	37,836
Hardwood	2,507,735	1,509,509	238,109	75,338	103,613	393,965	2,413	598	29,292	74,487	14,425	65,986
Total	9,068,407	6,565,205	488,234	102,367	974,890	537,853	31,274	91,657	43,959	106,171	22,975	103,822

1/ Prepared by Forest Service, U. S. Department of Agriculture.

2/ Volumes are board feet log scale, International 1/4-inch rule, and represent the net board-foot volume of the sawlog portion of live sawtimber trees (from stump to merchantable top) cut or killed in logging and converted to timber products or left as logging residues.

3/ Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood and other such products.

4/ Volumes are in cubic feet roundwood excluding bark and represent the net cubic-foot volume of live sawtimber trees from stump to minimum 4.0-inch top (of central stem) inside bark cut or killed in logging and converted to timber products or left as logging residues.

5/ Less than 0.5 thousand cubic feet.

Table 47.--Timber cut for all products from live sawtimber on commercial forest land in Eastern United States, by species group and by section and region of origin, 1952[1/]

VOLUME IN BOARD FEET

Species group	Total, East	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.
Softwoods:											
White, red, and jack pine	971,401	929,171	617,873	148,535	162,032	731	..	42,230	29,195	13,035	..
Southern yellow pine	11,609,957	257,184	8,006	178,001	..	60,953	10,224	11,352,773	3,228,160	5,545,510	2,579,103
Spruce-fir	668,476	668,226	560,644	63,791	43,791	..	..	250	250	..	..
Other softwoods	840,699	515,522	194,395	117,204	178,136	23,772	2,015	325,177	102,328	165,575	57,274
Total, softwoods	14,090,533	2,370,103	1,380,918	507,531	383,959	85,456	12,239	11,720,430	3,359,933	5,724,120	2,636,377
Hardwoods:											
Yellow-poplar	987,425	174,263	867	76,431	..	96,965	..	813,162	399,226	409,361	4,575
Other soft hardwoods	3,891,991	875,408	86,204	217,122	259,587	283,040	29,455	3,016,583	662,279	1,503,640	850,664
Total	4,879,416	1,049,671	87,071	293,553	259,587	380,005	29,455	3,829,745	1,061,505	1,913,001	855,239
Oak	4,894,225	1,614,427	41,168	486,451	157,274	898,840	30,694	3,279,798	803,789	1,405,138	1,070,871
Beech-yellow birch-hard maple	1,289,748	1,178,061	244,967	408,726	332,886	191,468	14	111,687	23,051	71,005	17,631
Other hard hardwoods	1,150,135	493,233	14,332	98,655	106,701	253,201	20,344	656,902	103,887	297,922	255,093
Total	7,334,108	3,285,721	300,467	993,832	596,861	1,343,509	51,052	4,048,387	930,727	1,774,065	1,343,595
Total, hardwoods	12,213,524	4,335,392	387,538	1,287,385	856,448	1,723,514	80,507	7,878,132	1,992,232	3,687,066	2,198,834
All species	26,304,057	6,705,495	1,768,456	1,794,916	1,240,407	1,808,970	92,746	19,598,562	5,352,165	9,411,186	4,835,211

VOLUME IN CUBIC FEET

Species group	Total, East	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
Softwoods:											
White, red, and jack pine	212,717	204,461	140,840	29,975	33,535	111	..	8,256	5,820	2,436	..
Southern yellow pine	2,346,277	53,792	1,740	40,736	..	9,405	1,911	2,292,485	684,123	1,117,112	491,250
Spruce-fir	145,799	145,749	120,099	13,426	12,224	..	..	50	50	..	..
Other softwoods	172,916	108,761	43,998	23,679	37,178	3,514	392	64,155	20,659	32,808	10,688
Total, softwoods	2,877,709	512,763	306,677	107,816	82,937	13,030	2,303	2,364,946	710,652	1,152,356	501,938
Hardwoods:											
Yellow-poplar	198,042	29,991	177	14,508	..	15,306	..	168,051	82,820	84,289	942
Other soft hardwoods	804,157	169,563	16,944	42,045	58,490	46,444	5,640	634,594	145,098	313,914	175,582
Total	1,002,199	199,554	17,121	56,553	58,490	61,750	5,640	802,645	227,918	398,203	176,524
Oak	1,004,552	294,336	8,418	98,351	35,444	145,815	6,308	710,216	182,677	300,328	227,211
Beech-yellow birch-hard maple	251,659	228,517	50,629	80,139	67,492	30,252	5	23,142	4,641	14,842	3,659
Other hard hardwoods	230,556	90,932	2,897	19,894	22,026	42,130	3,985	139,624	22,403	63,234	53,987
Total	1,486,767	613,785	61,944	198,384	124,962	218,197	10,298	872,982	209,721	378,404	284,857
Total, hardwoods	2,488,966	813,339	79,065	254,937	183,452	279,947	15,938	1,675,627	437,639	776,607	461,381
All species	5,366,675	1,326,102	385,742	362,753	266,389	292,977	18,241	4,040,573	1,148,291	1,928,963	963,319

1/ Prepared by Forest Service, U. S. Department of Agriculture. Volumes refer to live sawtimber inventory and are in board feet log scale, International 1/4-inch rule and in cubic feet roundwood excluding bark and represent the net board-foot volume of the sawlog portion of live sawtimber trees (from stump to merchantable top) and the net cubic-foot volume of live sawtimber trees from stump to minimum 4.0-inch top (of central stem) inside bark cut or killed in logging and converted to timber products or left as logging residues.

Table 48.--Timber cut for all products from live sawtimber on commercial forest land in Western United States, and Coastal Alaska, by species group, and by section and region of origin, 1952 1/

VOLUME IN BOARD FEET

Species group	Total, West and Coastal Alaska	West: Total	West: Pacific Northwest: Total	West: Pacific Northwest: Douglas-fir subregion	West: Pacific Northwest: Pine subregion	West: California	West: Northern Rocky Mountain	West: Southern Rocky Mountain	Coastal Alaska
	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.
Softwoods:									
Douglas-fir	11,961,923	11,961,923	9,192,326	8,826,808	365,518	2,333,575	392,829	43,193	..
Ponderosa and Jeffrey pine	3,603,266	3,603,266	1,497,450	149,552	1,347,898	1,274,048	474,256	357,512	..
Western hemlock	2,225,575	2,205,029	2,192,990	2,172,194	20,796	2,069	9,970	..	20,546
White and sugar pine	608,728	608,728	63,202	22,663	40,539	323,862	221,664	..	..
Redwood	986,864	986,864	..	..	..	986,864	..	..	..
Other softwoods	3,068,973	3,003,427	1,273,273	998,306	274,967	783,762	798,104	148,288	65,546
Total	22,455,329	22,369,237	14,219,241	12,169,523	2,049,718	5,704,180	1,896,823	548,993	86,092
Hardwoods	79,657	79,657	51,435	51,292	143	20,018	2,193	6,011	..
Total, all species	22,534,986	22,448,894	14,270,676	12,220,815	2,049,861	5,724,198	1,899,016	555,004	86,092

VOLUME IN CUBIC FEET

Species group	Total, West and Coastal Alaska	West: Total	West: Pacific Northwest: Total	West: Pacific Northwest: Douglas-fir subregion	West: Pacific Northwest: Pine subregion	West: California	West: Northern Rocky Mountain	West: Southern Rocky Mountain	Coastal Alaska
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
Softwoods:									
Douglas-fir	1,952,704	1,952,704	1,513,554	1,450,029	63,525	369,772	62,454	6,924	..
Ponderosa and Jeffrey pine	597,234	597,234	258,769	24,345	234,424	204,598	76,986	56,881	..
Western hemlock	372,503	369,591	367,664	364,183	3,481	314	1,613	..	2,912
White and sugar pine	96,272	96,272	10,836	3,780	7,056	50,759	34,677	..	..
Redwood	163,189	163,189	..	..	..	163,189	..	..	..
Other softwoods	501,061	491,817	214,492	166,929	47,563	126,682	125,801	24,842	9,244
Total	3,682,963	3,670,807	2,365,315	2,009,266	356,049	915,314	301,531	88,647	12,156
Hardwoods	18,634	18,634	8,593	8,571	22	8,567	384	1,090	..
Total, all species	3,701,597	3,689,441	2,373,908	2,017,837	356,071	923,881	301,915	89,737	12,156

1/ Prepared by Forest Service, U. S. Department of Agriculture. Volumes refer to live sawtimber inventory and are in board feet log scale, International 1/4-inch rule and in cubic feet roundwood excluding bark, and represent the net board-foot volume of the sawlog portion of live sawtimber trees (from stump to merchantable top) and the net cubic-foot volume of live sawtimber trees from stump to minimum 4.0-inch top (of central stem) inside bark cut or killed in logging and converted to timber products or left as logging residues.

Table 49.--Timber cut from growing stock on commercial forest land in the United States and Coastal Alaska, by product, section and region of origin, and by softwoods and hardwoods, 1952[1]

Section, region, and species group	Total, all products	Sawlogs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other[2]
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
North:												
New England:												
Softwood	361,082	199,400	..	3,624	153,380	2,245	223	184	1,875	..	..	151
Hardwood	139,136	58,046	13,740	110	36,038	29,412	83	..	587	..	..	1,120
Total	500,218	257,446	13,740	3,734	189,418	31,657	306	184	2,462	..	..	1,271
Middle Atlantic:												
Softwood	129,504	86,331	160	..	36,156	2,162	2,710	82	1,151	..	53	699
Hardwood	339,795	208,625	8,369	1,785	36,213	35,242	1,485	..	11,566	..	28,747	7,763
Total	469,299	294,956	8,529	1,785	72,369	37,404	4,195	82	12,717	..	28,800	8,462
Lake States:												
Softwood	188,566	55,621	73	..	108,846	6,670	230	1,831	8,839	..	4,662	1,794
Hardwood	348,604	139,061	13,932	298	70,035	97,792	404	..	7,517	..	2,072	17,493
Total	537,170	194,682	14,005	298	178,881	104,462	634	1,831	16,356	..	6,734	19,287
Central:												
Softwood	16,911	12,084	57	..	322	55	..	64	4,188	..	..	141
Hardwood	388,231	202,327	11,338	20,290	7,482	102,800	169	..	16,717	1,645	18,155	7,308
Total	405,142	214,411	11,395	20,290	7,804	102,855	169	64	20,905	1,645	18,155	7,449
Plains:												
Softwood	3,960	1,975	..	..	497	148	..	18	1,322	..	..	..
Hardwood	24,144	8,937	1,294	..	..	9,983	..	..	3,823	..	..	107
Total	28,104	10,912	1,294	..	497	10,131	..	18	5,145	..	..	107
Total, North:												
Softwood	700,023	355,411	290	3,624	299,201	11,280	3,163	2,179	17,375	..	4,715	2,785
Hardwood	1,239,910	616,996	48,673	22,483	149,768	275,229	2,141	..	40,210	1,645	48,974	33,791
Total	1,939,933	972,407	48,963	26,107	448,969	286,509	5,304	2,179	57,585	1,645	53,689	36,576
South:												
South Atlantic:												
Softwood	915,856	553,885	3,902	5,714	207,520	112,711	3,795	7,378	6,535	1,158	1,044	12,214
Hardwood	539,092	309,477	65,668	862	38,100	90,800	260	..	7,168	4,047	6,086	16,624
Total	1,454,948	863,362	69,570	6,576	245,620	203,511	4,055	7,378	13,703	5,205	7,130	28,838
Southeast:												
Softwood	1,479,153	835,391	4,494	16,937	464,547	73,976	8,098	35,600	7,302	22,098	3,067	7,643
Hardwood	926,306	435,449	87,662	29,692	53,917	241,966	27	..	21,584	24,488	2,610	28,911
Total	2,405,459	1,270,840	92,156	46,629	518,464	315,942	8,125	35,600	28,886	46,586	5,677	36,554
West Gulf:												
Softwood	651,101	390,018	948	..	177,851	22,967	9,139	29,807	9,110	8,505	304	2,452
Hardwood	541,745	232,261	38,949	22,736	20,527	150,645	..	590	12,645	46,567	506	16,319
Total	1,192,846	622,279	39,897	22,736	198,378	173,612	9,139	30,397	21,755	55,072	810	18,771
Total, South:												
Softwood	3,046,110	1,779,294	9,344	22,651	849,918	209,654	21,032	72,785	22,947	31,761	4,415	22,309
Hardwood	2,007,143	977,187	192,279	53,290	112,544	483,411	287	590	41,397	75,102	9,202	61,854
Total	5,053,253	2,756,481	201,623	75,941	962,462	693,065	21,319	73,375	64,344	106,863	13,617	84,163
West:												
Pacific Northwest:												
Douglas-fir subregion:												
Softwood	2,022,525	1,492,797	188,958	1,842	277,236	15,799	4,676	11,133	1,033	..	172	28,879
Hardwood	8,750	3,176	..	..	4,715	753	..	..	40	..	..	66
Total	2,031,275	1,495,973	188,958	1,842	281,951	16,552	4,676	11,133	1,073	..	172	28,945
Pine subregion:												
Softwood	359,249	340,995	2,398	..	6,798	3,522	..	2,442	2,436	..	473	185
Hardwood	22	..	..	..	22	..	..	..	..	..	..	..
Total	359,271	340,995	2,398	..	6,820	3,522	..	2,442	2,436	..	473	185
Total, Pacific Northwest:												
Softwood	2,381,774	1,833,792	191,356	1,842	284,034	19,321	4,676	13,575	3,469	..	645	29,064
Hardwood	8,772	3,176	..	..	4,737	753	..	..	40	..	..	66
Total	2,390,546	1,836,968	191,356	1,842	288,771	20,074	4,676	13,575	3,509	..	645	29,130

Table 49.--Timber cut from growing stock on commercial forest land in the United States and Coastal Alaska, by product, section and region of origin, and by softwoods and hardwoods, 1952[1] - Continued

Section, region, and species group	Total, all products	Sawlogs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other[2]
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
West: - Continued												
California:												
Softwood	920,389	853,295	47,926	827	9,936	540	819	1,144	3,108	28	445	2,321
Hardwood	11,147	9,316	268	1	263	60	9	10	62	(3/)	3	1,155
Total	931,536	862,611	48,194	828	10,199	600	828	1,154	3,170	28	448	3,476
Northern Rocky Mountain:												
Softwood	327,836	286,606	1,508	..	16,701	2,226	10	9,245	2,267	..	6,915	2,358
Hardwood	1,257	33	..	..	129	1,095	..	..	..	..	..	..
Total	329,093	286,639	1,508	..	16,830	3,321	10	9,245	2,267	..	6,915	2,358
Southern Rocky Mountain:												
Softwood	98,587	93,338	..	..	..	500	5	1,867	411	..	1,769	697
Hardwood	1,453	122	..	..	..	190	..	..	..	..	..	1,141
Total	100,040	93,460	..	..	..	690	5	1,867	411	..	1,769	1,838
Total, West:												
Softwood	3,728,586	3,067,031	240,790	2,669	310,671	22,587	5,510	25,831	9,255	28	9,774	34,440
Hardwood	22,629	12,647	268	1	5,129	2,098	9	10	102	(3/)	3	2,362
Total	3,751,215	3,079,678	241,058	2,670	315,800	24,685	5,519	25,841	9,357	28	9,777	36,802
Continental United States:												
Softwood	7,474,719	5,201,736	250,424	28,944	1,459,790	243,521	29,705	100,795	49,577	31,789	18,904	59,534
Hardwood	3,269,682	1,606,830	241,220	75,774	267,441	760,738	2,437	600	81,709	76,747	58,179	98,007
Total	10,744,401	6,808,566	491,644	104,718	1,727,231	1,004,259	32,142	101,395	131,286	108,536	77,083	157,541
Coastal Alaska:												
Softwood	12,372	11,887	4	..	267	20	180	10	4	..	..	..
Hardwood	..	..	..	..	..	..	..	..	..	..	..	..
Total	12,372	11,887	4	..	267	20	180	10	4	..	..	..
All regions:												
Softwood	7,487,091	5,213,623	250,428	28,944	1,460,057	243,541	29,885	100,805	49,581	31,789	18,904	59,534
Hardwood	3,269,682	1,606,830	241,220	75,774	267,441	760,738	2,437	600	81,709	76,747	58,179	98,007
Total	10,756,773	6,820,453	491,648	104,718	1,727,498	1,004,279	32,322	101,405	131,290	108,536	77,083	157,541

1/ Prepared by Forest Service, U. S. Department of Agriculture. Timber cut includes logging residues as well as growing stock inventory removed as timber products. Volumes are in cubic feet roundwood excluding bark.

2/ Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and other such products.

3/ Less than 0.5 thousand cubic feet.

Table 50.--Timber cut from growing stock on commercial forest land in Eastern United States, by product, by section and region of origin, and by softwoods and hardwoods, 1952 1/

Section, region, and species group	Total all products	Sawlogs (for lumber, etc.)	Veneer logs and bolts	Cooperage, logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other 2/
	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords
North:												
New England:												
Softwood	4,512	2,492	..	45	1,917	28	3	2	24	..	..	1
Hardwood	1,735	726	171	2	449	368	(3/)	..	6	..	..	13
Total	6,247	3,218	171	47	2,366	396	3	2	30	..	..	14
Middle Atlantic:												
Softwood	1,621	1,079	2	..	454	27	35	2	13	..	(3/)	9
Hardwood	4,249	2,609	105	23	453	440	18	..	145	..	359	97
Total	5,870	3,688	107	23	907	467	53	2	158	..	359	106
Lake States:												
Softwood	2,357	695	(3/)	..	1,361	89	3	23	110	..	56	20
Hardwood	4,354	1,737	175	4	875	1,223	5	..	91	..	26	218
Total	6,711	2,432	175	4	2,236	1,312	8	23	201	..	82	238
Central:												
Softwood	243	165	1	..	5	1	..	1	68	..	..	2
Hardwood	5,343	2,516	142	256	121	1,620	1	..	266	21	293	107
Total	5,586	2,681	143	256	126	1,621	1	1	334	21	293	109
Plains:												
Softwood	52	26	..	..	7	2	..	(3/)	17	..	..	..
Hardwood	336	122	17	..	..	142	..	..	53	..	..	2
Total	388	148	17	..	7	144	..	(3/)	70	..	..	2
Total North:												
Softwood	8,785	4,457	3	45	3,744	147	41	28	232	..	56	32
Hardwood	16,017	7,710	610	285	1,898	3,793	24	..	561	21	678	437
Total	24,802	12,167	613	330	5,642	3,940	65	28	793	21	734	469
South:												
South Atlantic:												
Softwood	12,128	7,044	49	74	2,968	1,595	46	90	90	13	13	146
Hardwood	6,903	3,822	798	10	484	1,357	4	..	100	48	80	200
Total	19,031	10,866	847	84	3,452	2,952	50	90	190	61	93	346
Southeast:												
Softwood	19,670	10,860	59	223	6,452	1,012	105	459	100	262	41	97
Hardwood	12,797	6,210	1,170	442	690	3,154	1	..	318	358	39	415
Total	32,467	17,070	1,229	665	7,142	4,166	106	459	418	620	80	512
West Gulf:												
Softwood	8,681	5,200	11	..	2,371	306	123	398	121	114	4	33
Hardwood	7,727	3,466	583	339	264	1,931	..	9	189	695	7	244
Total	16,408	8,666	594	339	2,635	2,237	123	407	310	809	11	277
Total South:												
Softwood	40,479	23,104	119	297	11,791	2,913	274	947	311	389	58	276
Hardwood	27,427	13,498	2,551	791	1,438	6,442	5	9	607	1,101	126	859
Total	67,906	36,602	2,670	1,088	13,229	9,355	279	956	918	1,490	184	1,135

1/ Prepared by Forest Service, U. S. Department of Agriculture. Estimates of timber cut refer to growing stock inventory and include logging residues as well as growing stock material removed as timber products. Volumes are in standard cords (128 cu. ft.) including bark.

2/ Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood and other such products.

3/ Less than 0.5 thousand cords.

Table 51.--Timber cut for all products from growing stock on commercial forest land in Eastern United States, by species group, and by section and region of origin, 1952[1/]

VOLUME IN CUBIC FEET

Species group	Total, East	North						South			
		Total	New England	Middle Atlantic	Lake States	Central	Plains	Total	South Atlantic	Southeast	West Gulf
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
Softwoods:											
White, red, and jack pine	256,760	247,828	152,790	30,703	64,222	113	..	8,932	6,341	2,591	..
Southern yellow pine	3,028,932	68,290	2,231	53,693	..	10,043	2,323	2,960,642	883,717	1,438,227	638,698
Spruce-fir	242,855	242,801	156,643	17,553	68,605	..	..	54	54	..	..
Other softwoods	217,567	141,085	49,418	27,555	55,739	6,755	1,618	76,482	25,744	38,335	12,403
Total, softwoods	3,746,114	700,004	361,082	129,504	188,566	16,911	3,941	3,046,110	915,856	1,479,153	651,101
Hardwoods:											
Yellow-poplar	216,683	35,147	212	18,551	..	16,384	..	181,536	90,870	89,644	1,022
Other soft hardwoods	1,055,556	322,090	37,964	55,499	168,313	53,297	7,017	733,466	175,882	360,193	197,391
Total	1,272,239	357,237	38,176	74,050	168,313	69,681	7,017	915,002	266,752	449,837	198,413
Oak	1,292,415	407,373	17,278	132,130	59,041	189,510	9,414	885,042	236,853	376,516	271,673
Beech-yellow birch-hard maple	324,787	299,501	79,610	97,301	90,485	32,092	13	25,286	4,797	16,546	3,943
Other hard hardwoods	357,477	175,664	4,072	36,314	30,765	96,948	7,565	181,813	30,690	83,407	67,716
Total	1,974,679	882,538	100,960	265,745	180,291	318,550	16,992	1,092,141	272,340	476,469	343,332
Total, hardwoods	3,246,918	1,239,775	139,136	339,795	348,604	388,231	24,009	2,007,143	539,092	926,306	541,745
All species	6,993,032	1,939,779	500,218	469,299	537,170	405,142	27,950	5,053,253	1,454,948	2,405,459	1,192,846

VOLUME IN CORDS

	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords	Thousand cords
Softwoods:											
White, red, and jack pine	3,212	3,098	1,910	383	803	1	..	114	80	34	..
Southern yellow pine	40,242	873	28	674	..	139	32	39,369	11,715	19,140	8,514
Spruce-fir	3,034	3,033	1,958	219	856	..	..	1	1	..	..
Other softwoods	2,776	1,781	616	345	698	103	20	995	332	496	167
Total, softwoods	49,264	8,785	4,512	1,621	2,357	243	52	40,479	12,128	19,670	8,681
Hardwoods:											
Yellow-poplar	2,820	443	2	233	..	208	..	2,377	1,127	1,235	15
Other soft hardwoods	14,104	4,062	474	693	2,104	696	95	10,042	2,235	4,947	2,860
Total	16,924	4,505	476	926	2,104	904	95	12,419	3,362	6,182	2,875
Oak	17,438	5,300	216	1,653	738	2,562	131	12,138	3,092	5,212	3,834
Beech-yellow birch-hard maple	4,106	3,750	995	1,216	1,130	409	..	356	60	239	57
Other hard hardwoods	4,975	2,461	48	454	382	1,468	109	2,514	389	1,164	961
Total	26,519	11,511	1,259	3,323	2,250	4,439	240	15,008	3,541	6,615	4,852
Total, hardwoods	43,443	16,016	1,735	4,249	4,354	5,343	335	27,427	6,903	12,797	7,727
All species	92,707	24,801	6,247	5,870	6,711	5,586	387	67,906	19,031	32,467	16,408

1/ Prepared by Forest Service, U. S. Department of Agriculture. Estimates of timber cut refer to growing stock inventory and include logging residues as well as growing stock material removed as timber products. Volumes are in cubic feet roundwood excluding bark and in standard cords (128 cu. ft.) including bark.

Table 52.--Timber cut for all products from growing stock on commercial forest land in Western United States and Coastal Alaska, by species group and by section and region of origin, 1952 1/

Species group	Total, West and Coastal Alaska	West							Coastal Alaska
		Total, West	Pacific Northwest			California	Northern Rocky Mountain	Southern Rocky Mountain	
			Total	Douglas-fir subregion	Pine subregion				
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
Softwoods:									
Douglas-fir	1,965,780	1,965,780	1,520,252	1,456,575	63,677	371,263	66,480	7,785	..
Ponderosa and Jeffrey pine	605,461	605,461	258,968	24,440	234,528	205,897	80,740	59,856	..
Western hemlock	376,511	373,426	371,465	367,943	3,522	327	1,634	..	3,085
White and sugar pine	96,894	96,894	10,859	3,792	7,067	50,899	35,136	..	..
Redwood	163,463	163,463	..	..	..	163,463	..	..	..
Other softwoods	532,849	523,562	220,230	169,775	50,455	128,540	143,846	30,946	9,287
Total	3,740,958	3,728,586	2,381,774	2,022,525	359,249	920,389	327,836	98,587	12,372
Hardwoods	22,629	22,629	8,772	8,750	22	11,147	1,257	1,453	..
All species	3,763,587	3,751,215	2,390,546	2,031,275	359,271	931,536	329,093	100,040	12,372

1/ Prepared by Forest Service, U. S. Department of Agriculture. Estimates of timber cut refer to growing stock inventory and include logging residues as well as growing stock material removed as timber products. Volumes are in cubic feet roundwood excluding bark.

Table 53.--Total volume of plant residues produced in the United States and Coastal Alaska from primary manufacturing, by industry, kind of material, and by section and region, 1952 1/

Section and region	All industries			Lumber			Veneer			Cooperage			Pulp			Other 2/		
	Total	Coarse	Fine	Total	Coarse	Fine	Total	Coarse	Fine	Total	Coarse	Fine	Total	Coarse	Fine	Total	Coarse	Fine
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
North:																		
New England	125,571	67,508	58,063	96,971	50,923	46,048	5,023	2,033	2,990	1,143	763	380	21,850	13,490	8.360	584	299	285
Middle Atlantic	143,143	79,530	63,613	115,369	63,702	51,667	3,030	1,290	1,740	670	500	170	21,100	12,260	8,840	2,974	1,778	1,196
Lake States	109,794	60,780	49,014	74,309	40,809	33,500	4,910	1,907	3,003	252	94	158	25,710	15,030	10,680	4,613	2,940	1,673
Central	88,276	53,921	34,355	66,349	40,739	25,610	4,027	2,023	2,004	12,468	9,168	3,300	2,788	1,533	1,255	2,644	458	2,186
Plains	4,005	2,015	1,990	3,554	1,812	1,742	433	196	237	..	..	..	..	..	..	18	7	11
Total	470,789	263,754	207,035	356,552	197,985	158,567	17,423	7,449	9,974	14,533	10,525	4,008	71,448	42,313	29,135	10,833	5,482	5,351
South:																		
South Atlantic	503,931	241,393	262,538	448,278	210,781	237,497	25,413	16,998	8,415	2,783	785	1,998	21,460	9,340	12,120	5,997	3,489	2,508
Southeast	662,349	298,262	364,087	570,379	255,757	314,622	33,851	16,952	16,899	16,402	8,567	7,835	34,700	13,800	20,900	7,017	3,186	3,831
West Gulf	308,277	124,126	184,151	267,043	108,140	158,903	14,209	4,359	9,850	5,714	3,143	2,571	17,950	7,140	10,810	3,361	1,344	2,017
Total	1,474,557	663,781	810,776	1,285,700	574,678	711,022	73,473	38,309	35,164	24,899	12,495	12,404	74,110	30,280	43,830	16,375	8,019	8,356
West:																		
Pacific Northwest:																		
Douglas-fir subregion	841,667	377,704	463,963	696,563	349,465	347,098	100,316	9,977	90,339	..	..	..	23,000	9,290	13,710	21,788	8,972	12,816
Pine subregion	130,476	58,202	72,274	128,653	57,878	70,775	1,353	134	1,219	..	..	..	470	190	280	..	..	..
Total	972,143	435,906	536,237	825,216	407,343	417,873	101,669	10,111	91,558	..	..	..	23,470	9,480	13,990	21,788	8,972	12,816
California	371,599	242,269	129,330	357,766	230,888	126,878	12,284	10,901	1,383	300	..	300	891	362	529	358	118	240
Northern Rocky Mountain	81,315	30,959	50,356	80,662	30,612	50,050	157	157	..	..	..	..	496	190	306	..	..	..
Southern Rocky Mountain	38,139	20,967	17,172	38,098	20,939	17,159	..	..	..	..	..	..	22	11	11	19	17	2
Total	1,463,196	730,101	733,095	1,301,742	689,782	611,960	114,110	21,169	92,941	300	..	300	24,879	10,043	14,836	22,165	9,107	13,058
Continental United States	3,408,542	1,657,636	1,750,906	2,943,994	1,462,445	1,481,549	205,006	66,927	138,079	39,732	23,020	16,712	170,437	82,636	87,801	49,373	22,608	26,765
Coastal Alaska	5,832	3,248	2,584	5,832	3,248	2,584	..	..	..	..	..	..	..	..	..	..	..	..
All Regions	3,414,374	1,660,884	1,753,490	2,949,826	1,465,693	1,484,133	205,006	66,927	138,079	39,732	23,020	16,712	170,437	82,636	87,801	49,373	22,608	26,765

1/ Prepared by Forest Service, U. S. Department of Agriculture. Plant residues include only the material left over from converting logs, bolts, and other round timbers to the primary product such as lumber, veneer, pulp etc. and residues from planing mills integrated with sawmills whether or not the material is subsequently burned as fuel, chipped for pulp or used for various other purposes. Coarse residues include slabs, edgings, trimmings, miscuts, veneer cores, cull pieces, and other material generally suitable for chipping. Fine residues include sawdust, shavings, veneer clippings, wood substance removed in barking, screenings, and other material generally too small for chipping.

2/ Includes shingle mills, box board, small dimension, turnery and excelsior plants, and other similar establishments utilizing roundwood.

Table 54.--Volume of plant residues from primary manufacturing used in the United States and Coastal Alaska, by industry source and type of use, and by section and region, 1952[1/]

Section, region, and kind of material	Relation of used residues to total residues	All industries				Lumber				Veneer				Cooperage			Pulp	Other[2/]			
		Total	Fuel[3/]	Fiber[4/]	Other[5/]	Total	Fuel[3/]	Fiber[4/]	Other[5/]	Total	Fuel[3/]	Fiber[4/]	Other[5/]	Total	Fuel[3/]	Other[5/]	Fuel[3/]	Total	Fuel[3/]	Fiber[4/]	Other[5/]
	Percent	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
North:																					
New England:																					
Coarse	63	42,549	40,454	441	1,654	26,035	24,366	19	1,650	1,999	1,580	417	2	745	744	1	13,490	280	274	5	1
Fine	69	39,897	17,655	10	22,232	28,166	6,253	..	21,913	2,786	2,680	..	106	339	333	6	8,360	246	29	10	207
Total	66	82,446	58,109	451	23,886	54,201	30,619	19	23,563	4,785	4,260	417	108	1,084	1,077	7	21,850	526	303	15	208
Middle Atlantic:																					
Coarse	68	54,382	48,548	266	5,568	38,741	33,860	..	4,881	1,200	638	266	296	435	424	11	12,260	1,746	1,366	..	380
Fine	58	37,246	19,336	..	17,910	25,646	8,417	..	17,229	1,604	1,561	..	43	78	1	77	8,840	1,078	517	..	561
Total	64	91,628	67,884	266	23,478	64,387	42,277	..	22,110	2,804	2,199	266	339	513	425	88	21,100	2,824	1,883	..	941
Lake States:																					
Coarse	92	56,259	48,885	874	6,500	36,454	30,260	804	5,390	1,891	711	70	1,110	94	94	..	15,030	2,790	2,790	..	..
Fine	65	31,882	25,070	..	6,812	16,765	10,084	..	6,681	2,853	2,818	..	35	114	79	35	10,680	1,470	1,409	..	61
Total	80	88,141	73,955	874	13,312	53,219	40,344	804	12,071	4,744	3,529	70	1,145	208	173	35	25,710	4,260	4,199	..	61
Central:																					
Coarse	76	40,739	35,265	465	5,009	30,769	26,138	..	4,631	1,969	1,145	465	359	6,106	6,087	19	1,533	362	362	..	..
Fine	67	22,998	14,525	..	8,473	16,605	10,015	..	6,590	1,795	1,776	..	19	1,659	154	1,505	1,255	1,684	1,325	..	359
Total	72	63,737	49,790	465	13,482	47,374	36,153	..	11,221	3,764	2,921	465	378	7,765	6,241	1,524	2,788	2,046	1,687	..	359
Plains:																					
Coarse	71	1,437	1,338	..	99	1,249	1,180	..	69	184	154	..	30	..	..	..	..	4	4	..	..
Fine	35	694	571	..	123	484	362	..	122	207	206	..	1	..	..	..	..	3	3	..	..
Total	53	2,131	1,909	..	222	1,733	1,542	..	191	391	360	..	31	..	..	..	..	7	7	..	..
Total North:																					
Coarse	74	195,366	174,490	2,046	18,830	133,248	115,804	823	16,621	7,243	4,228	1,218	1,797	7,380	7,349	31	42,313	5,182	4,796	5	381
Fine	64	132,717	77,157	10	55,550	87,666	35,131	..	52,535	9,245	9,041	..	204	2,190	567	1,623	29,135	4,481	3,283	10	1,188
Total	70	328,083	251,647	2,056	74,380	220,914	150,935	823	69,156	16,483	13,269	1,218	2,001	9,570	7,916	1,654	71,448	9,663	8,079	15	1,569
South:																					
South Atlantic:																					
Coarse	55	132,157	122,839	5,865	3,453	103,445	101,062	227	2,156	16,417	9,596	5,638	1,183	333	333	..	9,340	2,622	2,508	..	114
Fine	43	111,895	100,915	132	10,848	90,054	79,149	132	10,773	7,655	7,654	..	1	346	318	28	12,120	1,720	1,674	..	46
Total	48	244,052	223,754	5,997	14,301	193,499	180,211	359	12,929	24,072	17,250	5,638	1,184	679	651	28	21,460	4,342	4,182	..	160
Southeast:																					
Coarse	51	151,927	141,836	3,921	6,170	113,779	109,910	..	3,869	14,907	8,744	3,921	2,242	7,393	7,393	..	13,800	2,048	1,989	..	59
Fine	44	159,040	143,293	41	15,706	117,428	102,555	..	14,873	14,736	14,695	41	..	4,333	3,875	458	20,900	1,643	1,268	..	375
Total	47	310,967	285,129	3,962	21,876	231,207	212,465	..	18,742	29,643	23,439	3,962	2,242	11,726	11,268	458	34,700	3,691	3,257	..	434
West Gulf:																					
Coarse	65	80,202	73,817	1,666	4,719	65,916	60,819	405	4,692	3,649	2,361	1,261	27	2,791	2,791	..	7,140	706	706	..	..
Fine	66	122,383	119,319	..	3,064	100,711	98,096	..	2,615	8,670	8,670	..	..	1,599	1,428	171	10,810	593	315	..	278
Total	66	202,585	193,136	1,666	7,783	166,627	158,915	405	7,307	12,319	11,031	1,261	27	4,390	4,219	171	17,950	1,299	1,021	..	278
Total South:																					
Coarse	55	364,286	338,492	11,452	14,342	283,140	271,791	632	10,717	34,973	20,701	10,820	3,452	10,517	10,517	..	30,280	5,376	5,203	..	173
Fine	48	393,318	363,527	173	29,618	308,193	279,800	132	28,261	31,061	31,019	41	1	6,278	5,621	657	43,830	3,956	3,257	..	699
Total	51	757,604	702,019	11,625	43,960	591,333	551,591	764	38,978	66,034	51,720	10,861	3,453	16,795	16,138	657	74,110	9,332	8,460	..	872

Table 54.--Volume of plant residues from primary manufacturing used in the United States and Coastal Alaska, by industry source and type of use, and by section and region, 1952[1/]--Continued

Section, region, and kind of material	Relation of used residues to total residues	All industries: Total	All industries: Fuel[3/]	All industries: Fiber[4/]	All industries: Other[5/]	Lumber: Total	Lumber: Fuel[3/]	Lumber: Fiber[4/]	Lumber: Other[5/]	Veneer: Total	Veneer: Fuel[3/]	Veneer: Fiber[4/]	Veneer: Other[5/]	Cooperage: Total	Cooperage: Fuel[3/]	Cooperage: Other[5/]	Pulp: Fuel[3/]	Other[2/]: Total	Other[2/]: Fuel[3/]	Other[2/]: Fiber[4/]	Other[2/]: Other[5/]
	Percent	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
West:																					
Pacific Northwest:																					
D.-fir subregion:																					
Coarse	71	266,753	187,814	63,463	15,476	240,767	168,741	61,463	10,563	9,977	3,064	2,000	4,913	..	..	..	9,290	6,719	6,719	..	..
Fine	75	349,398	320,746	18,253	10,399	247,942	244,633	..	3,309	77,420	56,971	18,253	2,196	..	..	..	13,710	10,326	5,432	..	4,894
Total	73	616,151	508,560	81,716	25,875	488,709	413,374	61,463	13,872	87,397	60,035	20,253	7,109	..	..	..	23,000	17,045	12,151	..	4,894
Pine subregion:																					
Coarse	84	48,891	43,112	321	5,458	48,567	42,875	321	5,371	134	47	..	87	..	..	..	190	..	..	..	..
Fine	86	62,324	61,676	273	375	61,026	60,681	..	345	1,018	715	273	30	..	..	..	280	..	..	..	..
Total	85	111,215	104,788	594	5,833	109,593	103,556	321	5,716	1,152	762	273	117	..	..	..	470	..	..	..	..
Total Pacif. NW:																					
Coarse	72	315,644	230,926	63,784	20,934	289,334	211,616	61,784	15,934	10,111	3,111	2,000	5,000	..	..	..	9,480	6,719	6,719	..	..
Fine	77	411,722	382,422	18,526	10,774	308,968	305,314	..	3,654	78,438	57,686	18,526	[illegible],226	..	..	..	13,990	10,326	5,432	..	4,894
Total	75	727,366	613,348	82,310	31,708	598,302	516,930	61,784	19,588	88,549	60,797	20,526	7,226	..	..	..	23,470	17,045	12,151	..	4,894
California:																					
Coarse	33	79,922	61,623	7,970	10,329	71,742	56,942	6,761	8,039	7,802	4,303	1,209	2,290	..	..	..	362	15	16	..	..
Fine	49	63,526	61,745	..	1,781	61,514	59,971	..	1,543	1,149	990	..	159	300	255	45	529	34	..	..	34
Total	39	143,448	123,368	7,970	12,110	133,256	116,913	6,761	9,582	8,951	5,293	1,209	2,449	300	255	45	891	50	16	..	34
Northern Rocky Mtn:																					
Coarse	53	16,315	9,054	5,782	1,479	15,968	8,862	5,645	1,461	157	2	137	18	..	..	..	190	..	..	..	..
Fine	70	35,049	33,687	..	1,362	34,743	33,381	..	1,362	..	..	..	..	..	..	..	306	..	..	..	..
Total	63	51,364	42,741	5,782	2,841	50,711	42,243	5,645	2,823	157	2	137	18	..	..	..	496	..	..	..	..
Southern Rocky Mtn:																					
Coarse	62	13,052	10,550	..	2,502	13,041	10,539	..	2,502	..	..	..	..	..	..	..	11	..	..	..	..
Fine	47	8,086	5,466	..	2,620	8,075	5,455	..	2,620	..	..	..	..	..	..	..	11	..	..	..	..
Total	55	21,138	16,016	..	5,122	21,116	15,994	..	5,122	..	..	..	..	..	..	..	22	..	..	..	..
Total West:																					
Coarse	58	424,933	312,153	77,536	35,244	390,085	287,959	74,190	27,936	18,070	7,416	3,346	7,308	..	..	..	10,043	6,735	6,735	..	..
Fine	71	518,383	483,320	18,526	16,537	413,300	404,121	..	9,179	79,587	58,676	18,526	2,385	300	255	45	14,836	10,360	5,432	..	4,928
Total	64	943,316	795,473	96,062	51,781	803,385	692,080	74,190	37,115	97,657	66,092	21,872	9,693	300	255	45	24,879	17,095	12,167	..	4,928
Continental U. S.:																					
Coarse	59	984,585	825,135	91,034	68,416	806,473	675,554	75,645	55,274	60,286	32,345	15,384	12,557	17,897	17,866	31	82,636	17,293	16,734	5	554
Fine	60	1,044,418	924,004	18,709	101,705	809,159	719,052	132	89,975	119,893	98,736	18,567	2,590	8,768	6,443	2,325	87,801	18,797	11,972	10	6,815
Total	60	2,029,003	1,749,139	109,743	170,121	1,615,632	1,394,606	75,777	145,249	180,179	131,081	33,951	15,147	26,665	24,309	2,356	170,437	36,090	28,706	15	7,369
Coastal Alaska:																					
Coarse	30	976	617	..	359	976	617	..	359	..	..	..	..	..	..	..	..	..	..	..	..
Fine	71	1,843	1,843	..	..	1,843	1,843	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	48	2,819	2,460	..	359	2,819	2,460	..	359	..	..	..	..	..	..	..	..	..	..	..	..
All Regions:																					
Coarse	59	985,561	825,752	91,034	68,775	807,449	676,171	75,645	55,633	60,286	32,345	15,384	12,557	17,897	17,866	31	82,636	17,293	16,734	5	554
Fine	70	1,046,261	925,847	18,709	101,705	811,002	720,895	132	89,975	119,893	98,736	18,567	2,590	8,768	6,443	2,325	87,801	18,797	11,972	10	6,815
Total	60	2,031,822	1,751,599	109,743	170,480	1,618,451	1,397,066	75,777	145,608	180,179	131,081	33,951	15,147	26,665	24,309	2,356	170,437	36,090	28,706	15	7,369

1/ Prepared by Forest Service, U. S. Department of Agriculture. Plant residues include only the material left over from converting logs, bolts, and other round timbers to the primary product, such as lumber, veneer, and pulp, and residues from planing mills integrated with sawmills whether or not the material is subsequently burned as fuel, chipped for pulp or used for various other purposes. Part consists of coarse residues such as slabs, edgings, trimmings, miscuts, veneer cores, cull pieces, and other material generally suitable for chipping, and part consists of fine residues such as sawdust, shavings, veneer clippings, wood substance removed in barking, screenings and other material generally too small for chipping.

2/ Includes shingle mills, box board, small dimension, turnery and excelsior plants, and other similar establishments utilizing roundwood.

3/ Volume used for either industrial or home fuel or both.

4/ Volume used for pulp, hardboard, or other fiber products.

5/ Includes material for cut stock, handles, brush blocks, chemical wood, box board, particle board, floor cleaning compound, wood flour, insulation, bedding for livestock, poultry litter, soil conditioner, metallurgical use, and other similar purposes.

Table 55.--Volume of logging residues and unused plant residues from primary manufacturing in the United States and Coastal Alaska, by industry source and kind of material, and by section and region, 1952[1/]

Section and region	Total unused residues: Total	Total unused residues: Coarse	Total unused residues: Fine	Logging residues (coarse): Total	Logging residues (coarse): Lumber	Logging residues (coarse): Veneer	Logging residues (coarse): Cooperage	Logging residues (coarse): Pulp	Logging residues (coarse): Other[2/]
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
North:									
New England	88,415	70,249	18,166	45,290	35,513	2,749	165	5,911	952
Middle Atlantic	109,338	82,971	26,367	57,823	49,934	1,805	460	2,337	3,287
Lake States	84,741	67,609	17,132	63,088	36,852	2,858	62	15,513	7,803
Central	67,667	56,310	11,357	43,128	36,531	2,129	3,438	..	1,030
Plains	5,301	4,005	1,296	3,427	2,559	338	..	9	521
Total	355,462	281,144	74,318	212,756	161,389	9,879	4,125	23,770	13,593
South:									
South Atlantic	452,341	301,698	150,643	192,462	156,014	20,512	1,122	1,372	13,442
Southeast	679,899	474,852	205,047	328,517	221,762	27,358	14,689	10,656	54,052
West Gulf	290,218	228,450	61,768	184,526	108,126	12,113	12,465	5,612	46,210
Total	1,422,458	1,005,000	417,458	705,505	485,902	59,983	28,276	17,640	113,704
West:									
Pacific Northwest:									
D.-fir subregion	418,093	303,528	114,565	192,577	140,581	17,756	168	27,850	6,222
Pine subregion	57,867	47,917	9,950	38,606	36,641	257	..	734	974
Total	475,960	351,445	124,515	231,183	177,222	18,013	168	28,584	7,196
California	394,857	329,053	65,804	166,706	150,893	11,685	221	1,174	2,733
Northern Rocky Mtn:	63,033	47,726	15,307	33,082	30,022	156	..	598	2,306
Southern Rocky Mtn:	29,814	20,728	9,086	12,813	12,232	..	..	..	581
Total	963,664	748,952	214,712	443,784	370,369	29,854	389	30,356	12,816
Continental U. S.	2,741,584	2,035,096	706,488	1,362,045	1,017,660	99,716	32,790	71,766	140,113
Coastal Alaska	5,141	4,400	741	2,128	2,067	..	..	46	15
All Regions	2,746,725	2,039,496	707,229	1,364,173	1,019,727	99,716	32,790	71,812	140,128

Section and region	Unused plant residues: All industries: Total	All industries: Coarse	All industries: Fine	Lumber: Total	Lumber: Coarse	Lumber: Fine	Veneer: Total	Veneer: Coarse	Veneer: Fine	Cooperage: Total	Cooperage: Coarse	Cooperage: Fine	Other[3/]: Total	Other[3/]: Coarse	Other[3/]: Fine
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.
North:															
New England	43,125	24,959	18,166	42,770	24,888	17,882	238	34	204	59	18	41	58	19	39
Middle Atlantic	51,515	25,148	26,367	50,982	24,961	26,021	226	90	136	157	65	92	150	32	118
Lake States	21,653	4,521	17,132	21,090	4,355	16,735	166	16	150	44	..	44	353	150	203
Central	24,539	13,182	11,357	18,975	9,970	9,005	263	54	209	4,703	3,062	1,641	598	96	502
Plains	1,874	578	1,296	1,821	563	1,258	42	12	30	..	..	..	11	3	8
Total	142,706	68,388	74,318	135,638	64,737	70,901	935	206	729	4,963	3,145	1,818	1,170	300	870
South:															
South Atlantic	259,879	109,236	150,643	254,779	107,336	147,443	1,341	581	760	2,104	452	1,652	1,655	867	788
Southeast	351,382	146,335	205,047	339,172	141,978	197,194	4,208	2,045	2,163	4,676	1,174	3,502	3,326	1,138	2,188
West Gulf	105,692	43,924	61,768	100,416	42,224	58,192	1,890	710	1,180	1,324	352	972	2,062	638	1,424
Total	716,953	299,495	417,458	694,367	291,538	402,829	7,439	3,336	4,103	8,104	1,978	6,126	7,043	2,643	4,400
West:															
Pacific Northwest:															
D.-fir subregion	225,516	110,951	114,565	207,854	108,696	99,156	12,919	..	12,919	..	..	..	4,743	2,253	2,490
Pine subregion	19,261	9,311	9,950	19,060	9,311	9,749	201	..	201	..	..	..	..	..	..
Total	244,777	120,262	124,515	226,914	118,009	108,905	13,120	..	13,120	..	..	..	4,743	2,253	2,490
California	228,151	162,347	65,804	224,510	159,146	65,364	3,333	3,099	234	..	..	..	308	102	206
Northern Rocky Mtn:	29,951	14,644	15,307	29,951	14,644	15,307	..	..	..	..	..	..	..	..	..
Southern Rocky Mtn:	17,001	7,915	9,086	16,982	7,898	9,084	..	..	..	..	..	..	19	17	2
Total	519,880	305,168	214,712	498,357	299,697	198,660	16,453	3,099	13,354	..	..	..	5,070	2,372	2,698
Continental U. S.	1,379,539	673,051	706,488	1,328,362	655,972	672,390	24,827	6,641	18,186	13,067	5,123	7,944	13,283	5,315	7,968
Coastal Alaska	3,013	2,272	741	3,013	2,272	741	..	..	..	..	..	..	..	..	..
All Regions	1,382,552	675,323	707,229	1,331,375	658,244	673,131	24,827	6,641	18,186	13,067	5,123	7,944	13,283	5,315	7,968

1/ Prepared by Forest Service, U. S. Department of Agriculture. Logging residues refer to that part of growing stock inventory cut or killed in logging and left unused in the woods. Plant residues include only the material left over from converting logs, bolts, and other round timbers to the primary product such as lumber, veneer, pulp, etc., and residues from planing mills integrated with sawmills whether or not the material is subsequently burned as fuel, chipped for pulp or used for various other purposes. Coarse residues include slabs, edgings, trimmings, miscuts, veneer cores, cull pieces, and other material generally suitable for chipping. Fine residues include sawdust, shavings, veneer clippings, wood substance removed in barking, screenings, and other material generally too small for clipping.

2/ Includes logging residues originating in such operations as poles, piling, posts, hewn ties, round mine timbers, fuelwood, and miscellaneous logging industries. Volumes are in cubic feet roundwood excluding bark.

3/ Includes shingle mills, box board, small dimension, turnery and excelsior plants, and other similar establishments utilizing roundwood.

Table 56.--Comparison of net annual growth with timber cut from growing stock and live sawtimber on commercial forest land in the United States and Coastal Alaska, by species group, 1952[1/]

Species group	Growing stock: Timber cut	Growing stock: Growth 2/	Growing stock: Relation of growth to timber cut	Sawtimber: Timber cut	Sawtimber: Growth 2/	Sawtimber: Relation of growth to timber cut
	Million cu. ft.	Million cu. ft.	Percent	Million bd. ft.	Million bd. ft.	Percent
Eastern species:						
Softwoods:						
White, red, and jack pine	257	270	105	972	906	93
Southern yellow pines	3,029	3,483	115	11,610	14,155	122
Spruce and fir	243	291	120	668	742	111
Other softwoods	217	341	157	841	1,167	139
Total softwoods	3,746	4,385	117	14,091	16,970	120
Hardwoods:						
Soft hardwoods:						
Yellow-poplar	217	289	133	988	948	96
Other soft hardwoods	1,055	2,290	217	3,892	6,041	155
Total	1,272	2,579	203	4,880	6,989	143
Hard hardwoods:						
Oaks	1,292	2,478	192	4,894	7,316	149
Beech, yellow birch, hard maple	325	718	221	1,290	1,877	146
Other hard hardwoods	358	1,306	365	1,150	2,939	256
Total	1,975	4,502	228	7,334	12,132	165
Total hardwoods	3,247	7,081	218	12,214	19,121	156
Total, eastern species	6,993	11,466	164	26,305	36,091	137
Western species:						
Softwoods:						
Douglas-fir	1,966	902	46	11,962	4,431	37
Ponderosa and Jeffrey pine[3/]	605	479	79	3,603	1,841	51
Western hemlock	377	237	63	2,225	1,038	47
White and sugar pine	97	100	103	609	535	88
Redwood	163	77	47	987	396	40
Other softwoods	533	833	156	3,069	2,800	91
Total softwoods	3,741	2,628	70	22,455	11,041	49
Hardwoods	23	149	648	80	265	327
Total, western species	3,764	2,777	74	22,535	11,306	50
All softwoods	7,487	7,013	94	36,546	28,011	77
All hardwoods	3,270	7,230	221	12,294	19,386	158
All species	10,757	14,243	132	48,840	47,397	97

1/ Prepared by Forest Service, U. S. Department of Agriculture. Growing stock volumes are in net cubic feet excluding bark. Sawtimber volumes are in net board feet log scale, International 1/4-inch rule. Timber cut refers to net inventory volume cut or killed in logging and converted to timber products or left as logging residues.

2/ The considerable excess of cut over growth for most western softwoods is not entirely due to overcutting. Growth is at a low level partly because 40 percent of the commercial forest area consists of old-growth timber, which contributes little to net annual growth.

3/ Estimates of net growth for ponderosa and Jeffrey pine exclude 4 million cubic feet and 16 million board feet of ponderosa pine in the Plains Region and combined here with other eastern softwoods. Total net annual growth of ponderosa and Jeffrey pine in the United States is 483 million cubic feet and 1,857 million board feet.

Table 57.--Comparison of net annual growth with timber cut from live sawtimber on commercial forest land in the United States and Coastal Alaska, by softwoods and hardwoods, and by section and region, 1952[1]

Section and region	All species			Softwood			Hardwood		
	Timber cut	Growth	Relation of growth to timber cut	Timber cut	Growth 2/	Relation of growth to timber cut	Timber cut	Growth	Relation of growth to timber cut
	Million bd. ft.	Million bd. ft.	Percent	Million bd. ft.	Million bd. ft.	Percent	Million bd. ft.	Million bd. ft.	Percent
North:									
New England	1,768	1,857	105	1,381	914	66	387	943	244
Middle Atlantic	1,795	3,160	176	508	470	92	1,287	2,690	209
Lake States	1,240	2,693	217	384	802	209	856	1,891	221
Central	1,809	3,963	219	85	249	293	1,724	3,714	215
Plains	94	401	426	12	40	333	82	361	440
Total	6,706	12,074	180	2,370	2,475	104	4,336	9,599	221
South:									
South Atlantic	5,352	6,880	128	3,360	3,670	109	1,992	3,210	161
Southeast	9,411	10,035	107	5,724	6,679	117	3,687	3,356	91
West Gulf	4,836	7,102	147	2,637	4,146	157	2,199	2,956	134
Total	19,599	24,017	122	11,721	14,495	124	7,878	9,522	121
West:									
Pacific Northwest:									
Douglas-fir subregion	12,221	5,149	42	12,169	5,010	41	52	139	267
Pine subregion	2,050	828	40	2,050	824	40	(3/)	4	..
Total	14,271	5,977	42	14,219	5,834	41	52	143	275
California	5,724	2,939	51	5,704	2,895	51	20	44	220
Northern Rocky Mountain	1,899	1,534	81	1,897	1,508	79	2	26	1,300
Southern Rocky Mountain	555	728	131	549	677	123	6	51	850
Total	22,449	11,178	50	22,369	10,914	49	80	264	330
Continental United States	48,754	47,269	97	36,460	27,884	76	12,294	19,385	158
Coastal Alaska	86	128	149	86	127	148	..	.1	..
All regions	48,840	47,397	97	36,546	28,011	77	12,294	19,386	158

1/ Prepared by Forest Service, U. S. Department of Agriculture. Volumes are in net board feet log scale, International 1/4-inch rule. Timber cut refers to net inventory volume cut or killed in logging and converted to timber products or left as logging residues.

2/ The considerable excess of cut over growth for most western softwoods is not entirely due to overcutting. Growth is at a low level partly because 40 percent of the commercial forest area consists of old-growth timber which contributes little to net annual growth.

3/ Less than 0.5 million board feet.

Table 58.--Comparison of net annual growth with timber cut from live sawtimber on commercial forest land in Eastern United States, by species group, and by section and region, 1952 1/

Section and region	Total all species	Softwoods					Total hardwoods	Soft hardwoods			Hard hardwoods			
		Total	White, red, and jack pine	Southern yellow pines	Spruce and fir	Other softwoods		Total	Yellow-poplar	Other soft hardwoods	Total	Oaks	Beech, y. birch, and hard maple	Other hard hardwoods
North:														
New England:														
Timber cut . . . . million bd. ft.	1,768	1,381	618	8	560	195	387	87	1	86	300	41	245	14
Growth . . . . . . do.	1,857	914	298	2	426	188	943	75	5	70	868	125	534	209
Relation of growth to cut . . . . percent	105	66	48	25	76	96	244	86	500	81	289	305	218	1,493
Middle Atlantic:														
Timber cut . . . . million bd. ft.	1,795	508	149	178	64	117	1,287	294	77	217	993	486	408	99
Growth . . . . . . do.	3,160	470	124	107	67	172	2,690	546	155	391	2,144	983	733	428
Relation of growth to cut . . . . percent	176	92	83	60	105	147	209	186	201	180	216	202	180	432
Lake States:														
Timber cut . . . . million bd. ft.	1,240	384	162	..	44	178	856	259	..	259	597	157	333	107
Growth . . . . . . do.	2,693	802	417	..	248	137	1,891	1,239	..	1,239	652	440	158	54
Relation of growth to cut . . . . percent	217	209	257	..	564	77	221	478	..	478	109	280	47	50
Central:														
Timber cut . . . . million bd. ft.	1,809	85	(2/)	61	..	24	1,724	380	97	283	1,344	899	192	253
Growth . . . . . . do.	3,963	249	6	184	..	59	3,714	905	163	742	2,809	1,672	297	640
Relation of growth to cut . . . . percent	219	293	..	302	..	246	215	238	168	262	209	208	155	253
Plains:														
Timber cut . . . . million bd. ft.	94	12	..	10	..	2	82	30	..	30	52	31	(2/)	21
Growth . . . . . . do.	401	40	..	24	..	3/ 16	361	236	..	236	125	66	..	59
Relation of growth to cut . . . . percent	426	333	..	240	..	800	440	787	..	787	240	213	..	281
Total North:														
Timber cut . . . . . million bd. ft.	6,706	2,370	929	257	668	516	4,336	1,050	175	875	3,286	1,614	1,178	494
Growth . . . . do.	12,074	2,475	845	317	741	572	9,599	3,001	323	2,678	6,598	3,486	1,722	1,390
Relation of growth to cut . . . . percent	180	104	91	123	111	111	221	286	184	306	201	216	146	281
South:														
South Atlantic:														
Timber cut . . . . million bd. ft.	5,352	3,360	30	3,228	(2/)	102	1,992	1,062	400	662	930	804	23	103
Growth . . . . . . do.	6,880	3,670	41	3,493	1	135	3,210	1,401	383	1,018	1,809	1,334	38	437
Relation of growth to cut . . . . percent	128	109	137	108	..	132	161	132	96	154	194	165	165	424
Southeast:														
Timber cut . . . . million bd. ft.	9,411	5,724	13	5,546	..	165	3,687	1,913	409	1,504	1,774	1,405	71	298
Growth . . . . . . do.	10,035	6,679	20	6,378	..	281	3,356	1,493	239	1,254	1,863	1,257	73	533
Relation of growth to cut . . . . percent	107	117	154	115	..	170	91	78	58	83	105	89	103	179
West Gulf:														
Timber cut . . . . million bd. ft.	4,836	2,637	..	2,579	..	58	2,199	855	4	851	1,344	1,071	18	255
Growth . . . . . . do.	7,102	4,146	..	3,967	..	179	2,956	1,094	3	1,091	1,862	1,239	44	579
Relation of growth to cut . . . . percent	147	157	..	154	..	308	134	128	75	128	138	116	244	227
Total South:														
Timber cut . . . . . million bd. ft.	19,599	11,721	43	11,353	(2/)	325	7,878	3,830	813	3,017	4,048	3,280	112	656
Growth . . . . do.	24,017	14,495	61	13,838	1	595	9,522	3,988	625	3,363	5,534	3,830	155	1,549
Relation of growth to cut . . . . percent	122	124	142	122	..	183	121	104	77	111	137	117	138	236
Total Eastern United States:														
Timber cut . . . . . million bd. ft.	26,305	14,091	972	11,610	668	841	12,214	4,880	988	3,892	7,334	4,894	1,290	1,150
Growth . . . . do.	36,091	16,970	906	14,155	742	1,167	19,121	6,989	948	6,041	12,132	7,316	1,677	2,939
Relation of growth to cut . . . . percent	137	120	93	122	111	139	156	143	96	155	165	149	146	256

1/ Prepared by Forest Service, U. S. Department of Agriculture. Volumes are in net board feet log scale, International 1/4-inch rule. Timber cut refers to net inventory volume cut or killed in logging and converted to timber products or left as logging residues.

2/ Less than 0.5 million board feet.

3/ Net growth of ponderosa pine. Total net growth of ponderosa and Jeffrey pine in the United States is 1,857 million board feet including 16 million board feet in the Plains Region.

Table 59.--Comparison of net annual growth with timber cut from live sawtimber on commercial forest land in Western United States and Coastal Alaska, by species group, and by section and region, 1952[1]

Section and region	Total, all species	Softwoods: Total	Softwoods: Douglas-fir	Softwoods: Ponderosa and Jeffrey pine	Softwoods: Western hemlock	Softwoods: White and sugar pine	Softwoods: Redwood	Softwoods: Other softwoods	Hardwoods
West:									
Pacific Northwest:									
Douglas-fir subregion:									
Timber cut . . . . . million bd. ft.	12,221	12,169	8,827	149	2,172	23	..	998	52
Growth . . . . do.	5,149	5,010	3,022	57	911	98	..	922	139
Relation of growth to cut . . . . . . percent	42	41	34	38	42	426	..	92	267
Pine subregion:									
Timber cut . . . . . million bd. ft.	2,050	2,050	366	1,348	21	40	..	275	(2/)
Growth . . . . do.	828	824	171	439	20	21	..	173	4
Relation of growth to cut . . . . . . percent	40	40	47	32	95	52	..	63	..
Total									
Timber cut . . . . million bd. ft.	14,271	14,219	9,193	1,497	2,193	63	..	1,273	52
Growth[3] . . . . . do.	5,977	5,834	3,193	496	931	119	..	1,095	143
Relation of growth to cut . . . . . percent	42	41	35	33	42	189	..	86	275
California:									
Timber cut . . . . . . million bd. ft.	5,724	5,704	2,333	1,274	2	324	987	784	20
Growth . . . . do.	2,939	2,895	787	553	9	207	396	943	44
Relation of growth to cut . . . . percent	51	51	34	43	450	64	40	120	220
Northern Rocky Mountain:									
Timber cut . . . . . . million bd. ft.	1,899	1,897	393	475	9	222	..	798	2
Growth . . . . do.	1,534	1,508	388	368	27	209	..	516	26
Relation of growth to cut . . . . percent	81	79	99	77	300	94	..	65	1,300
Southern Rocky Mountain:									
Timber cut . . . . . . million bd. ft.	555	549	43	357	..	..	..	149	6
Growth . . . . do.	728	677	63	424	..	..	..	190	51
Relation of growth to cut . . . . percent	131	123	146	119	..	..	..	128	850
Total, West:									
Timber cut . . . . million bd. ft.	22,449	22,369	11,962	3,603	2,204	609	987	3,004	80
Growth . . . . do.	11,178	10,914	4,431	[4] 1,841	967	535	396	2,744	264
Relation of growth to cut . . . . percent	50	49	37	51	44	88	40	91	330
Coastal Alaska:									
Timber cut . . . . million bd. ft.	86	86	..	..	21	..	..	65	..
Growth . . . . do.	128	127	..	..	71	..	..	56	1
Relation of growth to cut . . . . percent	149	148	..	..	338	..	..	86	..
Total western U. S. and Coastal Alaska:									
Timber cut . . . . million bd. ft.	22,535	22,455	11,962	3,603	2,225	609	987	3,069	80
Growth . . . . do.	11,306	11,041	4,431	[4] 1,841	1,038	535	396	2,800	265
Relation of growth to cut . . . . percent	50	49	37	51	47	88	40	91	331

1/ Prepared by Forest Service, U. S. Department of Agriculture. Volumes are in net board feet log scale, International 1/4-inch rule. Timber cut refers to net inventory volume cut or killed in logging and converted to timber products or left as logging residues.

2/ Less than 0.5 million board feet.

3/ The considerable excess of cut over growth for the principal softwoods in the Pacific Northwest and California is not entirely due to overcutting. Growth is at a low level partly because a comparatively high proportion of the commercial forest area consists of old-growth timber which contributes little to net annual growth.

4/ Excludes 16 million board feet net growth of ponderosa pine in the Plains Region. Total net growth of ponderosa and Jeffrey pine in the United States is 1,857 million board feet.

Table 60.--Comparison of net annual growth with timber cut from growing stock on commercial forest land in the United States and Coastal Alaska, by softwoods and hardwoods, and by section and region, 1952 1/

Section and region	All species: Timber cut	All species: Growth	All species: Relation of growth to timber cut	Softwood: Timber cut	Softwood: Growth 2/	Softwood: Relation of growth to timber cut	Hardwood: Timber cut	Hardwood: Growth	Hardwood: Relation of growth to timber cut
	Million cu. ft.	Million cu. ft.	Percent	Million cu. ft.	Million cu. ft.	Percent	Million cu. ft.	Million cu. ft.	Percent
North:									
New England	500	878	176	361	291	81	139	587	422
Middle Atlantic	470	1,357	289	130	156	130	340	1,201	353
Lake States	537	1,180	220	188	319	170	349	861	247
Central	405	1,128	278	17	46	270	388	1,082	279
Plains	28	116	414	4	9	225	24	107	446
Total	1,940	4,659	240	700	821	117	1,240	3,838	310
South:									
South Atlantic	1,455	1,908	131	916	969	106	539	939	174
Southeast	2,405	3,056	127	1,479	1,714	116	926	1,342	145
West Gulf	1,193	1,843	154	651	881	135	542	962	177
Total	5,053	6,807	135	3,046	3,564	117	2,007	3,243	162
West:									
Pacific Northwest:									
Douglas-fir subregion	2,031	998	49	2,022	943	47	9	55	611
Pine subregion	359	329	92	359	329	92	(3/)	..	..
Total	2,390	1,327	55	2,381	1,272	53	9	55	611
California	932	595	64	921	539	59	11	56	509
Northern Rocky Mountain	329	603	183	328	591	180	1	12	1,200
Southern Rocky Mountain	100	220	220	98	194	198	2	26	1,300
Total	3,751	2,745	73	3,728	2,596	70	23	149	648
Continental United States	10,744	14,211	132	7,474	6,981	93	3,270	7,230	221
Coastal Alaska	13	32	246	13	32	246	..	(3/)	..
All regions	10,757	14,243	132	7,487	7,013	94	3,270	7,230	221

1/ Prepared by Forest Service, U. S. Department of Agriculture. Volumes are in net cubic feet excluding bark. Timber cut refers to net inventory volume cut or killed in logging and converted to timber products or left as logging residues.

2/ The considerable excess of cut over growth in the Pacific Northwest and California is not entirely due to overcutting. Growth is at a low level partly because a comparatively high proportion of the commercial forest area consists of old-growth timber which contributes little to net annual growth.

3/ Less than 0.5 million cubic feet.

Table 61.--Comparison of net annual growth with timber cut from growing stock on commercial forest land in Eastern United States, by species group, and by section and region, 1952[1]

Section and region	Total all species	Softwoods: Total	Softwoods: White, red, and jack pine	Softwoods: Southern yellow pines	Softwoods: Spruce and fir	Softwoods: Other softwoods	Total hardwoods	Soft hardwoods: Total	Soft hardwoods: Yellow-poplar	Soft hardwoods: Other soft hardwoods	Hard hardwoods: Total	Hard hardwoods: Oaks	Hard hardwoods: Beech, y. birch, and hard maple	Hard hardwoods: Other hard hardwoods
North:														
New England:														
Timber cut . . . . million cu. ft.	500	361	153	2	157	49	139	38	(2/)	38	101	17	80	4
Growth . . . . . . do.	878	291	83	1	145	62	587	76	1	75	511	75	252	184
Relation of growth to cut . . . . percent	176	81	54	50	92	126	422	200	..	197	506	441	315	4,600
Middle Atlantic:														
Timber cut . . . . million cu. ft.	470	130	31	54	18	27	340	74	19	55	266	132	98	36
Growth . . . . . . do.	1,357	156	32	48	23	53	1,201	217	63	154	984	436	272	276
Relation of growth to cut . . . . percent	289	120	103	89	128	196	283	293	332	280	370	330	278	767
Lake States:														
Timber cut . . . . million cu. ft.	537	188	64	..	68	56	349	169	..	169	180	59	90	31
Growth . . . . . . do.	1,180	319	139	..	122	58	861	621	..	621	240	148	77	15
Relation of growth to cut . . . . percent	220	170	217	..	179	104	247	367	..	367	133	251	86	48
Central:														
Timber cut . . . . million cu. ft.	405	17	(2/)	10	..	7	388	69	16	53	319	190	32	97
Growth . . . . . . do.	1,128	46	(2/)	33	..	13	1,082	245	40	205	837	536	70	231
Relation of growth to cut . . . . percent	278	270	..	330	..	186	279	355	250	387	262	282	219	238
Plains:														
Timber cut . . . . million cu. ft.	28	4	..	2	..	2	24	7	..	7	17	9	(2/)	8
Growth . . . . . . do.	116	9	..	5	..	3/ 4	107	63	..	63	44	20	..	24
Relation of growth to cut . . . . percent	414	225	..	250	..	200	446	900	..	900	259	222	..	300
Total North:														
Timber cut . . . . . million cu. ft.	1,940	700	248	68	243	141	1,240	357	35	322	883	407	300	176
Growth . . . . do.	4,659	821	254	87	290	190	3,838	1,222	104	1,118	2,616	1,215	671	730
Relation of growth to cut . . . . percent	240	117	102	128	119	135	310	342	297	347	296	298	224	415
South:														
South Atlantic:														
Timber cut . . . . million cu. ft.	1,455	916	6	884	(2/)	26	539	267	91	176	272	237	4	31
Growth . . . . . . do.	1,908	969	11	920	1	37	939	401	111	290	538	384	11	143
Relation of growth to cut . . . . percent	131	106	183	104	..	142	174	150	122	165	198	162	275	461
Southeast:														
Timber cut . . . . million cu. ft.	2,405	1,479	3	1,438	..	38	926	450	90	360	476	376	17	83
Growth . . . . . . do.	3,056	1,714	5	1,630	..	79	1,342	606	73	533	736	486	23	227
Relation of growth to cut . . . . percent	127	116	167	113	..	208	145	135	81	148	155	129	135	273
West Gulf:														
Timber cut . . . . million cu. ft.	1,193	651	..	639	..	12	542	198	1	197	344	272	4	68
Growth . . . . . . do.	1,843	881	..	846	..	35	962	350	1	349	612	393	13	206
Relation of growth to cut . . . . percent	154	135	..	132	..	292	177	177	100	177	178	144	325	303
Total South:														
Timber cut . . . . . million cu. ft.	5,053	3,046	9	2,961	(2/)	76	2,007	915	182	733	1,092	885	25	182
Growth . . . . do.	6,807	3,564	16	3,396	1	151	3,243	1,357	185	1,172	1,886	1,263	47	576
Relation of growth to cut . . . . percent	135	117	178	115	..	199	162	148	102	160	173	143	188	316
Total Eastern United States:														
Timber cut . . . . . million cu. ft.	6,993	3,746	257	3,029	243	217	3,247	1,272	217	1,055	1,975	1,292	325	358
Growth . . . . do.	11,466	4,385	270	3,483	291	341	7,081	2,579	289	2,290	4,502	2,478	718	1,306
Relation of growth to cut . . . . percent	164	117	105	115	120	157	218	203	133	217	228	192	221	365

1/ Prepared by Forest Service, U. S. Department of Agriculture. Volumes are in net cubic feet, excluding bark. Timber cut refers to net inventory volume cut or killed in logging and converted to timber products or left as logging residues.

2/ Less than 0.5 million cubic feet.

3/ Net growth of ponderosa pine. Total net annual growth of ponderosa and Jeffrey pine in the United States is 483 million cubic feet including 4 million cubic feet in the Plains Region.

Table 62.--Comparison of net annual growth with timber cut from growing stock on commercial forest land in Western United States and Coastal Alaska, by species group, and by section and region, 1952 1/

Section and region	Total, all species	Softwoods: Total	Softwoods: Douglas-fir	Softwoods: Ponderosa and Jeffrey pine	Softwoods: Western hemlock	Softwoods: White and sugar pine	Softwoods: Redwood	Softwoods: Other softwoods	Hardwoods
West:									
Pacific Northwest:									
Douglas-fir subregion:									
Timber cut . . . . . million cu. ft.	2,031	2,022	1,456	24	368	4	..	170	9
Growth . . . . do.	998	943	529	8	205	14	..	187	55
Relation of growth to cut . . . . . . percent	49	47	36	33	56	350	..	110	611
Pine subregion:									
Timber cut . . . . . million cu. ft.	359	359	64	235	3	7	..	50	(2/)
Growth . . . . do.	329	329	60	159	3	8	..	99	..
Relation of growth to cut . . . . . . percent	92	92	94	68	100	114	..	198	..
Total									
Timber cut . . . . million cu. ft.	2,390	2,381	1,520	259	371	11	..	220	9
Growth 3/ . . . . . do.	1,327	1,272	589	167	208	22	..	286	55
Relation of growth to cut . . . . . percent	56	53	39	64	56	200	..	130	611
California:									
Timber cut . . . . . . million cu. ft.	932	921	371	206	1	51	163	129	11
Growth 3/ . . . . do.	595	539	144	99	2	32	77	185	56
Relation of growth to cut . . . . percent	64	59	39	48	200	63	47	143	509
Northern Rocky Mountain:									
Timber cut . . . . . . million cu. ft.	329	328	67	81	1	35	..	144	1
Growth . . . . do.	603	591	150	108	9	46	..	278	12
Relation of growth to cut . . . . percent	183	180	224	133	900	131	..	193	1,200
Southern Rocky Mountain:									
Timber cut . . . . . . million cu. ft.	100	98	8	59	..	..	..	31	2
Growth . . . . do.	220	194	19	105	..	(2/)	..	70	26
Relation of growth to cut . . . . percent	220	197	237	178	..	..	..	226	1,300
Total, West:									
Timber cut . . . . million cu. ft.	3,751	3,728	1,966	605	373	97	163	524	23
Growth . . . . do.	2,745	2,596	902	4/ 479	219	100	77	819	149
Relation of growth to cut . . . . percent	73	70	46	79	59	103	47	156	648
Coastal Alaska:									
Timber cut . . . . million cu. ft.	13	13	..	..	4	..	..	9	..
Growth . . . . do.	32	32	..	..	18	..	..	14	(2/)
Relation of growth to cut . . . . percent	246	246	..	..	450	..	..	156	..
Total, western U. S. and Coastal Alaska:									
Timber cut . . . . million cu. ft.	3,764	3,741	1,966	605	377	97	163	533	23
Growth . . . . do.	2,777	2,628	902	4/ 479	237	100	77	833	149
Relation of growth to cut . . . . percent	74	70	46	79	63	103	47	156	648

1/ Prepared by Forest Service, U. S. Department of Agriculture. Volumes are in net cubic feet, excluding bark. Timber cut refers to net inventory volume cut or killed in logging and converted to timber products or left as logging residues.

2/ Less than 0.5 million cubic feet.

3/ The considerable excess of cut over growth for the principal softwoods in the Pacific Northwest and California is not entirely due to overcutting. Growth is at a low level partly because a comparatively high proportion of the commercial forest area consists of old-growth timber which contributes little to net annual growth.

4/ Excludes 4 million cubic feet net growth of ponderosa pine in the Plains Region. Total net annual growth of ponderosa and Jeffrey pine in the United States is 483 million cubic feet.

Table 63.--Area burned on commercial and noncommercial forest land requiring protection in the United States and Coastal Alaska, by ownership class, and by section and region, 1952[1/]

Section and region	All ownerships	Federal ownership or trusteeship					State, county, and municipal	Private
		Total	National forest	Indian	Bureau of Land Management	Other		
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
North:								
New England	36,071	..	..	..	..	..	71	36,000
Middle Atlantic	748,000	4,000	4,000	..	..	..	21,000	723,000
Lake States	41,636	3,160	1,218	1,627	40	275	5,733	32,743
Central	2,792,168	50,163	33,155	..	..	17,008	7,062	2,734,943
Plains	1,155,119	64,105	605	30,500	..	33,000	18,771	1,072,243
Total	4,772,994	121,428	38,978	32,127	40	50,283	52,637	4,598,929
South:								
South Atlantic	614,635	45,017	27,300	4,428	..	13,289	8,919	560,699
Southeast	7,381,010	91,331	39,548	20,000	5,000	26,783	181,447	7,108,232
West Gulf	1,676,275	42,869	8,299	1,920	4,589	28,061	15,835	1,617,571
Total	9,671,920	179,217	75,147	26,348	9,589	68,133	206,201	9,286,502
West:								
Pacific Northwest	65,698	13,553	9,487	297	3,767	2	3,917	48,228
California	143,726	26,302	13,977	1,805	10,453	67	1,050	116,374
Northern Rocky Mountain	33,274	7,165	4,703	1,217	1,072	173	3,017	23,092
Southern Rocky Mountain	22,913	13,979	6,110	2,253	5,489	127	191	8,743
Total	265,611	60,999	34,277	5,572	20,781	369	8,175	196,437
Continental United States	14,710,525	361,644	148,402	64,047	30,410	118,785	267,013	14,081,868
Coastal Alaska	631	630	628	..	2	..	..	1
All regions	[2/] 14,711,156	362,274	149,030	64,047	30,412	118,785	267,013	14,081,869

1/ Prepared by Forest Service, U. S. Department of Agriculture.
2/ About 1,501,000 acres of the total area burned consisted of noncommercial and nonforest land, the latter in California and North Dakota. This area was distributed as follows: 1,189,000 acres in the North, 158,000 acres in the South, and 154,000 acres in the West.

Table 64.--Annual mortality of growing stock and live sawtimber on commercial forest land in the United States and Coastal Alaska, by softwoods and hardwoods, by cause, and by section and region, 1952[1]

GROWING STOCK

Section and region	All species					Softwood					Hardwood				
	Total	Fire	Insects	Disease	Other[2]	Total	Fire	Insects	Disease	Other[2]	Total	Fire	Insects	Disease	Other[2]
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
North:															
New England	298	4	23	218	53	99	1	10	57	31	199	3	13	161	22
Middle Atlantic	233	8	8	39	178	64	1	2	24	37	169	7	6	15	141
Lake States	485	2	34	166	283	122	1	6	19	96	363	1	28	147	187
Central	102	21	..	29	52	4	1	..	1	2	98	20	..	28	50
Plains	28	1	(3/)	9	18	2	(3/)	(3/)	(3/)	2	26	1	(3/)	9	16
Total	1,146	36	65	461	584	291	4	18	101	168	855	32	47	360	416
South:															
South Atlantic	95	16	23	20	36	64	11	19	11	23	31	5	4	9	13
Southeast	314	71	42	40	161	149	36	37	16	60	165	35	5	24	101
West Gulf	220	39	47	13	121	85	14	42	2	27	135	25	5	11	94
Total	629	126	112	73	318	298	61	98	29	110	331	65	14	44	208
West:															
Pacific Northwest:															
Douglas-fir subregion	551	34	225	62	230	537	34	225	62	216	14	..	..	..	14
Pine subregion	196	..	89	16	91	196	..	89	16	91	..	..	..	..	..
Total	747	34	314	78	321	733	34	314	78	307	14	..	..	..	14
California	359	21	228	45	65	336	21	228	37	50	23	(3/)	..	8	15
Northern Rocky Mountain	308	7	158	36	107	306	7	158	36	105	2	(3/)	(3/)	(3/)	2
Southern Rocky Mountain	200	11	66	31	92	179	11	60	24	84	21	(3/)	6	7	8
Total	1,614	73	766	190	585	1,554	73	760	175	546	60	(3/)	6	15	39
Continental United States	3,389	235	943	724	1,487	2,143	138	876	305	824	1,246	97	67	419	663
Coastal Alaska	100	1	27	49	23	100	1	27	49	23	(3/)	(3/)	..	(3/)	(3/)
All regions	3,489	236	970	773	1,510	2,243	139	903	354	847	1,246	97	67	419	663

SAWTIMBER

Section and region	Total	Fire	Insects	Disease	Other[2]	Total	Fire	Insects	Disease	Other[2]	Total	Fire	Insects	Disease	Other[2]
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
North:															
New England	645	7	53	475	110	268	1	42	164	61	377	6	11	311	49
Middle Atlantic	354	10	24	107	213	115	2	8	75	30	239	8	16	32	183
Lake States	698	3	20	193	482	209	2	6	34	167	489	1	14	159	315
Central	312	46	..	111	155	13	3	..	3	7	299	43	..	108	148
Plains	70	5	2	28	35	5	(4/)	1	1	3	65	5	1	27	32
Total	2,079	71	99	914	995	610	8	57	277	268	1,469	63	42	637	727
South:															
South Atlantic	267	47	72	68	80	191	36	65	45	45	76	11	7	23	35
Southeast	841	154	156	124	407	455	91	146	51	167	386	63	10	73	240
West Gulf	660	93	184	41	342	326	45	178	9	94	334	48	6	32	248
Total	1,768	294	412	233	829	972	172	389	105	306	796	122	23	128	523
West:															
Pacific Northwest:															
Douglas-fir subregion	3,105	189	1,313	369	1,234	3,056	189	1,313	369	1,185	49	..	..	..	49
Pine subregion	932	4	422	75	431	932	4	422	75	431	..	..	..	..	..
Total	4,037	193	1,735	444	1,665	3,988	193	1,735	444	1,616	49	..	..	..	49
California	1,865	131	1,358	204	172	1,811	129	1,358	182	142	54	2	..	22	30
Northern Rocky Mountain	1,475	27	833	134	481	1,472	27	833	134	478	3	..	(4/)	(4/)	3
Southern Rocky Mountain	906	63	298	146	399	849	63	283	122	381	57	(4/)	15	24	18
Total	8,283	414	4,224	928	2,717	8,120	412	4,209	882	2,617	163	2	15	46	100
Continental United States	12,130	779	4,735	2,075	4,541	9,702	592	4,655	1,264	3,191	2,428	187	80	811	1,350
Coastal Alaska	392	2	98	204	88	392	2	98	204	88	(4/)	(4/)	..	(4/)	(4/)
All regions	12,522	781	4,833	2,279	4,629	10,094	594	4,753	1,468	3,279	2,428	187	80	811	1,350

1/ Prepared by Forest Service, U. S. Department of Agriculture. Mortality in cubic feet, excluding bark and in board feet log scale, International 1/4-inch rule. Estimates represent current level of mortality indicated by trends over a long period of years, as determined in 1952.

2/ Weather, animals, suppression, etc.
3/ Less than 0.5 million cubic feet.
4/ Less than 0.5 million board feet.

Table 63.--Mortality in 1952, and estimated growth loss and growth impact of damage to growing stock and live sawtimber during 1952, on commercial forest land in the United States and Coastal Alaska, by cause, and by section and region[1]

GROWING STOCK

Section and region	All causes				Fire			Disease			Insects			Other[2]		
	Mortality	Salvage[3]	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
North:																
New England	298	6	515	813	4	3	7	218	429	647	23	43	66	53	40	93
Middle Atlantic	233	33	683	916	8	38	46	39	511	550	8	59	67	178	75	253
Lake States	485	61	1,355	1,840	2	2	4	166	508	674	34	136	170	283	709	992
Central	102	45	530	632	21	101	122	29	265	294	..	92	92	52	72	124
Plains	28	5	76	104	1	13	14	9	25	34	..	3	3	18	35	53
Total	1,146	150	3,159	4,305	36	157	193	461	1,738	2,199	65	333	398	584	931	1,515
South:																
South Atlantic	95	67	517	612	16	89	105	20	326	346	23	95	118	36	7	43
Southeast	314	118	2,100	2,414	71	852	923	40	1,102	1,142	42	97	139	161	49	210
West Gulf	220	53	753	973	39	311	350	13	346	359	47	59	106	121	37	158
Total	629	238	3,370	3,999	126	1,252	1,378	73	1,774	1,847	112	251	363	318	93	411
West:																
Pacific Northwest	747	339	408	1,155	34	27	61	78	192	270	314	122	436	321	67	388
California	359	17	207	566	21	11	32	45	146	191	228	16	244	65	34	99
Northern Rocky Mountain	329	18	294	623	7	3	10	36	252	288	188	22	210	98	17	115
Southern Rocky Mountain	200	7	143	343	11	1	12	31	70	101	66	20	86	92	52	144
Total	1,635	381	1,052	2,687	73	42	115	190	660	850	796	180	976	576	170	746
Continental United States	3,410	769	7,581	10,991	235	1,451	1,686	724	4,172	4,896	973	764	1,737	1,478	1,194	2,672
Coastal Alaska	100	(4/)	118	218	1	1	2	49	103	152	27	14	41	23	..	23
All Regions	3,510	769	7,699	11,209	236	1,452	1,688	773	4,275	5,048	1,000	778	1,778	1,501	1,194	2,695

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Section and region	All causes: Mortality	All causes: Salvage[3]	All causes: Growth loss	All causes: Growth impact	Fire: Mortality	Fire: Growth loss	Fire: Growth impact	Disease: Mortality	Disease: Growth loss	Disease: Growth impact	Insects: Mortality	Insects: Growth loss	Insects: Growth impact	Other: Mortality	Other: Growth loss	Other: Growth impact
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
North:																
New England	645	11	1,810	2,455	7	20	27	475	1,592	2,067	53	122	175	110	76	186
Middle Atlantic	354	85	2,673	3,027	10	287	297	107	2,138	2,245	24	141	165	213	107	320
Lake States	698	70	4,544	5,242	3	6	9	193	1,794	1,987	20	674	694	482	2,070	2,552
Central	312	104	2,486	2,798	46	446	492	111	1,439	1,550	..	359	359	155	242	397
Plains	70	10	244	314	5	56	61	28	106	134	2	19	21	35	63	98
Total	2,079	280	11,757	13,836	71	815	886	914	7,069	7,983	99	1,315	1,414	995	2,558	3,553
South:																
South Atlantic	267	78	2,319	2,586	47	450	497	68	1,499	1,567	72	330	402	80	40	120
Southeast	841	357	8,236	9,077	154	3,650	3,804	124	3,962	4,086	156	391	547	407	233	640
West Gulf	660	180	3,113	3,773	93	1,408	1,501	41	1,259	1,300	184	328	512	342	118	460
Total	1,768	615	13,668	15,436	294	5,508	5,802	233	6,720	6,953	412	1,049	1,461	829	391	1,220
West:																
Pacific Northwest	4,037	1,988	2,056	6,093	193	182	375	444	987	1,431	1,735	783	2,518	1,665	104	1,769
California	1,865	102	1,177	3,042	131	66	197	204	930	1,134	1,358	94	1,452	172	87	259
Northern Rocky Mountain	1,620	75	1,462	3,082	27	12	39	97	1,199	1,296	1,041	164	1,205	455	87	542
Southern Rocky Mountain	906	29	537	1,443	63	6	69	146	316	462	298	96	394	399	119	518
Total	8,428	2,194	5,232	13,660	414	266	680	891	3,432	4,323	4,432	1,137	5,569	2,691	397	3,088
Continental United States	12,275	3,089	30,657	42,932	779	6,589	7,368	2,038	17,221	19,259	4,943	3,501	8,444	4,515	3,346	7,861
Coastal Alaska	392	(5/)	503	895	2	2	4	204	426	630	98	75	173	88	..	88
All Regions	12,667	3,089	31,160	43,827	781	6,591	7,372	2,242	17,647	19,889	5,041	3,576	8,617	4,603	3,346	7,949

1/ Prepared by Forest Service, U. S. Department of Agriculture. Mortality estimates represent actual losses in 1952. In all but the Northern Rocky Mountain Region actual mortality was found to agree closely with the current level of mortality indicated by trends over a long period of years, as determined in 1952. In the Northern Rocky Mountain Region, actual mortality of growing stock for 1952 was found to be well above this level for insect losses, at the same level for fire and disease losses and slightly below for losses due to animals, weather, suppression, etc. For sawtimber, actual mortality in the Northern Rocky Mountain Region was well above the current level for insect losses, at the same level for fire losses, and substantially below this level for disease losses and losses due to animals, weather, suppression, etc.

2/ Animals, weather, suppression, etc.

3/ Volume of dead trees utilized in 1952.

4/ Less than 0.5 million cubic feet.

5/ Less than 0.5 million board feet.

Table 66.--Mortality from disease in 1952, and estimated growth loss and growth impact of damage to growing stock and live sawtimber during 1952, on commercial forest land in the United States and Coastal Alaska, by type of disease, and by section and region[1/]

Section and region	All diseases			Root diseases			Stem diseases			Foliage diseases			Systemic diseases			Other[2/]		
	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact
GROWING STOCK																		
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
North:																		
New England	218	429	647	..	..	..	63	349	412	..	..	..	147	57	204	8	23	31
Middle Atlantic	39	511	550	..	..	..	27	466	493	..	..	..	1	12	13	11	33	44
Lake States	166	508	674	..	..	..	117	484	601	..	..	..	11	..	11	38	24	62
Central	29	265	294	..	..	..	..	241	241	..	..	..	2	..	2	27	24	51
Plains	9	25	34	..	..	..	3	25	28	..	..	..	..	..	..	6	..	6
Total	461	1,738	2,199	..	..	..	210	1,565	1,775	..	..	..	161	69	230	90	104	194
South:																		
South Atlantic	20	326	346	3	14	17	8	274	282	..	3	3	1	2	3	8	33	41
Southeast	40	1,102	1,142	5	21	26	18	995	1,013	..	9	9	5	18	23	12	59	71
West Gulf	13	346	359	..	..	..	1	288	289	..	4	4	6	15	21	6	39	45
Total	73	1,774	1,847	8	35	43	27	1,557	1,584	..	16	16	12	35	47	26	131	157
West:																		
Pacific Northwest	78	192	270	44	52	96	15	111	126	..	..	..	..	..	..	19	29	48
California	45	146	191	..	..	..	..	82	82	..	..	..	..	..	..	45	64	109
Northern Rocky Mtn.	36	252	288	..	..	..	14	235	249	8	1	9	11	3	14	3	13	16
Southern Rocky Mtn.	31	70	101	..	..	..	13	56	69	..	..	..	..	..	..	18	14	32
Total	190	660	850	44	52	96	42	484	526	8	1	9	11	3	14	85	120	205
Continental U. S.	724	4,172	4,896	52	87	139	279	3,606	3,885	8	17	25	184	107	291	201	355	556
Coastal Alaska	49	103	152	..	..	..	..	..	..	..	..	..	..	..	..	49	103	152
All Regions	773	4,275	5,048	52	87	139	279	3,606	3,885	8	17	25	184	107	291	250	458	708
SAWTIMBER																		
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
North:																		
New England	475	1,592	2,067	..	..	..	171	1,370	1,541	..	..	..	287	173	460	17	49	66
Middle Atlantic	107	2,138	2,245	..	..	..	81	2,035	2,116	..	..	..	3	32	35	23	71	94
Lake States	193	1,794	1,987	..	..	..	88	1,732	1,820	..	..	..	31	8	39	74	54	128
Central	111	1,439	1,550	..	..	..	1	1,355	1,356	..	..	..	7	1	8	103	83	186
Plains	28	106	134	..	..	..	7	103	110	..	..	..	..	..	..	21	3	24
Total	914	7,069	7,983	..	..	..	348	6,595	6,943	..	..	..	328	214	542	238	260	498
South:																		
South Atlantic	68	1,499	1,567	16	44	60	25	1,321	1,346	..	11	11	1	7	8	26	116	142
Southeast	124	3,962	4,086	18	68	86	55	3,641	3,696	..	36	36	4	13	17	47	204	251
West Gulf	41	1,259	1,300	..	..	..	4	1,075	1,079	..	12	12	4	12	16	33	160	193
Total	233	6,720	6,953	34	112	146	84	6,037	6,121	..	59	59	9	32	41	106	480	586
West:																		
Pacific Northwest	444	987	1,431	261	193	454	86	653	739	..	..	..	..	..	..	97	141	238
California	204	930	1,134	..	..	..	..	607	607	..	..	..	..	..	..	204	323	527
Northern Rocky Mtn.	97	1,199	1,296	..	..	..	10	1,112	1,122	40	6	46	27	34	61	20	47	67
Southern Rocky Mtn.	146	316	462	..	..	..	60	251	311	..	..	..	..	..	..	86	65	151
Total	891	3,432	4,323	261	193	454	156	2,623	2,779	40	6	46	27	34	61	407	576	983
Continental U. S.	2,038	17,221	19,259	295	305	600	588	15,255	15,843	40	65	105	364	280	644	751	1,316	2,067
Coastal Alaska	204	426	630	..	..	..	..	..	..	..	..	..	..	..	..	204	426	630
All Regions	2,242	17,647	19,889	295	305	600	588	15,255	15,843	40	65	105	364	280	644	955	1,742	2,697

1/ Prepared by Forest Service, U. S. Department of Agriculture. Mortality estimates represent actual losses due to diseases in 1952. They also represent the current level of mortality of growing stock indicated by trends over a long period of years, as determined in 1952. In all but the Northern Rocky Mountain Region actual mortality of sawtimber due to disease was found to agree closely with the current trend level. In the Northern Rocky Mountain Region, however, actual mortality of sawtimber in 1952 was found to be substantially below this level.

2/ Includes many stem rusts, root rots, leaf and needle diseases, Dutch elm disease, phloem necrosis of elm, and persimmon wilt.

Table 67.--Mortality from insects in 1952, and estimated growth loss and growth impact of damage to growing stock and live sawtimber during 1952, on commercial forest land in the United States and Coastal Alaska by groups of insects and by section and region[1]

GROWING STOCK

Section and region	All insects			Bark beetles			Defoliators			Other[2]		
	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
North:												
New England	23	43	66	5	..	5	11	9	20	7	34	41
Middle Atlantic	8	59	67	1	..	1	..	31	31	7	28	35
Lake States	34	136	170	..	..	..	1	129	130	33	7	40
Central	..	92	92	..	..	..	..	8	8	..	84	84
Plains	..	3	3	..	..	..	..	2	2	..	1	1
Total	65	333	398	6	..	6	12	179	191	47	154	201
South:												
South Atlantic	23	95	118	19	..	19	..	10	10	4	85	89
Southeast	42	97	139	34	5	39	..	11	11	9	81	90
West Gulf	47	59	106	33	10	43	3	9	12	10	40	50
Total	112	251	363	86	15	101	3	30	33	23	206	229
West:												
Pacific Northwest	314	122	436	312	101	413	1	21	22	.1	..	1
California	228	16	244	187	14	201	..	..	..	41	2	43
Northern Rocky Mountain	188	22	210	188	..	188	..	22	22	..	..	..
Southern Rocky Mountain	66	20	86	62	1	63	3	19	22	1	..	1
Total	796	180	976	749	116	865	4	62	66	43	2	45
Continental United States	973	764	1,737	841	131	972	19	271	290	113	362	475
Coastal Alaska	27	14	41	..	..	..	..	12	12	27	2	29
All regions	1,000	778	1,778	841	131	972	19	283	302	140	364	504

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Section and region	All insects: Mortality	All insects: Growth loss	All insects: Growth impact	Bark beetles: Mortality	Bark beetles: Growth loss	Bark beetles: Growth impact	Defoliators: Mortality	Defoliators: Growth loss	Defoliators: Growth impact	Other: Mortality	Other: Growth loss	Other: Growth impact
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
North:												
New England	53	122	175	26	..	26	6	7	13	21	115	136
Middle Atlantic	24	141	165	2	..	2	1	61	62	21	80	101
Lake States	20	674	694	..	..	..	2	647	649	18	27	45
Central	..	359	359	..	..	..	..	37	37	..	322	322
Plains	2	19	21	1	1	2	..	9	9	1	9	10
Total	99	1,315	1,414	29	1	30	9	761	770	61	553	614
South:												
South Atlantic	72	330	402	63	..	63	..	38	38	9	292	301
Southeast	156	391	547	134	25	159	..	39	39	22	327	349
West Gulf	184	328	512	137	76	213	2	40	42	45	212	257
Total	412	1,049	1,461	334	101	435	2	117	119	76	831	907
West:												
Pacific Northwest	1,735	783	2,518	1,724	657	2,381	5	125	130	6	1	7
California	1,358	94	1,452	1,117	79	1,196	..	..	..	241	15	256
Northern Rocky Mountain	1,041	164	1,205	1,041	31	1,072	..	133	133	..	..	..
Southern Rocky Mountain	298	96	394	282	19	301	15	76	91	1	1	2
Total	4,432	1,137	5,569	4,164	786	4,950	20	334	354	248	17	265
Continental United States	4,943	3,501	8,444	4,527	888	5,415	31	1,212	1,243	385	1,401	1,786
Coastal Alaska	98	75	173	..	..	..	..	62	62	98	13	111
All regions	5,041	3,576	8,617	4,527	888	5,415	31	1,274	1,305	483	1,414	1,897

1/ Prepared by Forest Service, U. S. Department of Agriculture. Mortality estimates represent actual losses due to insects in 1952. In all but the Northern Rocky Mountain Region actual mortality was found to agree closely with the current level of mortality indicated by trends over a long period of years, as determined in 1952. In the Northern Rocky Mountain Region actual mortality of both growing stock and sawtimber in 1952 was found to be well above this level.

2/ Includes hardwood borers, white pine weevil, pine tip moths, turpentine borer, cone and seed insects, Saratoga spittlebug, and the balsam woolly aphid.

Table 68.--Mortality from weather, animals, and miscellaneous causes in 1952, and estimated growth loss and growth impact of damage to growing stock and live sawtimber during 1952, on commercial forest land in the United States and Coastal Alaska, by section and region[1/]

GROWING STOCK

Section and region	All miscellaneous			Weather			Animals			Other[2/]		
	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
North:												
New England	53	40	93	28	11	39	9	12	21	16	17	33
Middle Atlantic	178	75	253	90	17	107	18	15	33	70	43	113
Lake States	283	709	992	92	..	92	9	709	718	182	..	182
Central	52	72	124	..	..	..	..	72	72	52	..	52
Plains	18	35	53	6	1	7	3	22	25	9	12	21
Total	584	931	1,515	216	29	245	39	830	869	329	72	401
South:												
South Atlantic	36	7	43	12	3	15	1	2	3	23	2	25
Southeast	161	49	210	65	16	81	..	18	18	96	15	111
West Gulf	121	37	158	41	12	53	..	18	18	80	7	87
Total	318	93	411	118	31	149	1	38	39	199	24	223
West:												
Pacific Northwest	321	67	388	308	6	314	13	61	74	..	..	..
California	65	34	99	..	..	..	..	..	..	65	34	99
Northern Rocky Mountain	98	17	115	98	7	105	..	4	4	..	6	6
Southern Rocky Mountain	92	52	144	80	41	121	12	11	23	..	..	..
Total	576	170	746	486	54	540	25	76	101	65	40	105
Continental United States	1,478	1,194	2,672	820	114	934	65	944	1,009	593	136	729
Coastal Alaska	23	..	23	23	..	23	..	..	..	..	..	..
All regions	1,501	1,194	2,695	843	114	957	65	944	1,009	593	136	729

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Section and region	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
North:												
New England	110	76	186	60	25	85	16	23	39	34	28	62
Middle Atlantic	213	107	320	108	37	145	19	27	46	86	43	129
Lake States	482	2,070	2,552	310	..	310	42	2,070	2,112	130	..	130
Central	155	242	397	..	..	..	..	242	242	155	..	155
Plains	35	63	98	21	36	57	2	10	12	12	17	29
Total	995	2,558	3,553	499	98	597	79	2,372	2,451	417	88	505
South:												
South Atlantic	80	40	120	40	24	64	1	2	3	39	14	53
Southeast	407	233	640	206	81	287	..	79	79	201	73	274
West Gulf	342	118	460	150	74	224	..	5	5	192	39	231
Total	829	391	1,220	396	179	575	1	86	87	432	126	558
West:												
Pacific Northwest	1,665	104	1,769	1,613	79	1,692	52	25	77	..	..	..
California	172	87	259	..	..	..	..	..	..	172	87	259
Northern Rocky Mountain	455	87	542	450	35	485	..	21	21	5	31	36
Southern Rocky Mountain	399	119	518	341	91	432	58	28	86	..	..	..
Total	2,691	397	3,088	2,404	205	2,609	110	74	184	177	118	295
Continental United States	4,515	3,346	7,861	3,299	482	3,781	190	2,532	2,722	1,026	332	1,358
Coastal Alaska	88	..	88	88	..	88	..	..	..	..	..	..
All regions	4,603	3,346	7,949	3,387	482	3,869	190	2,532	2,722	1,026	332	1,358

1/ Prepared by Forest Service, U. S. Department of Agriculture. Mortality estimates represent actual losses due to animals, weather, suppression, etc., in 1952. In all but the Northern Rocky Mountain Region actual mortality was found to agree closely with the current level of mortality indicated by trends over a long period of years, as determined in 1952. In the Northern Rocky Mountain Region actual mortality of both growing stock and sawtimber in 1952 was found to be below this level.

2/ Principally suppression.

Table 69.--Growth impact of damage by fire to growing stock during 1952 on commercial forest land in the United States and Coastal Alaska, by ownership class, and by section and region[1/]

Section and region	All ownerships	Federal ownership or trusteeship: Total	National	Indian	Bureau of Land Management	Other	State, county, and municipal	Private
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
North:								
New England	6.7	..	..	..	..	..	(2/)	6.7
Middle Atlantic	46.5	0.4	0.4	..	..	..	0.3	45.8
Lake States	3.9	.5	.4	0.1	..	(2/)	.5	2.9
Central	121.8	3.2	2.2	..	..	1.0	.3	118.3
Plains	14.2	.6	..	.3	..	.3	.2	13.4
Total	193.1	4.7	3.0	.4	..	1.3	1.3	187.1
South:								
South Atlantic	104.2	7.5	4.3	.9	..	2.3	1.5	95.2
Southeast	923.0	11.9	4.9	2.5	0.6	3.9	22.6	888.5
West Gulf	350.2	9.1	1.7	.4	1.0	6.0	3.3	337.8
Total	1377.4	28.5	10.9	3.8	1.6	12.2	27.4	1321.5
West:								
Pacific Northwest	61.4	15.8	13.5	..	2.3	..	3.7	41.9
California	32.0	16.3	15.4	.4	.5	..	.4	15.3
Northern Rocky Mountain	10.0	4.4	3.7	.2	.5	..	.2	5.4
Southern Rocky Mountain	11.7	9.9	9.8	..	.1	..	.7	1.1
Total	115.1	46.4	42.4	.6	3.4	..	5.0	63.7
Continental United States	1685.6	79.6	56.3	4.8	5.0	13.5	33.7	1572.3
Coastal Alaska	2.0	2.0	2.0	..	..	..	..	..
All regions	1687.6	81.6	58.3	4.8	5.0	13.5	33.7	1572.3

1/ Prepared by Forest Service, U. S. Department of Agriculture.
2/ Less than 0.05 million cubic feet.

Table 70.--Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by type of ownership, size class of private ownership, and by section and region, 1953[1]

Section and region	All public: Operating area	All public: Productivity: High	All public: Productivity: Medium	All public: Productivity: Low	National forest: Operating area	National forest: Productivity: High	National forest: Productivity: Medium	National forest: Productivity: Low	Bureau of land management: Operating area	Bureau of land management: Productivity: High	Bureau of land management: Productivity: Medium	Bureau of land management: Productivity: Low	Indian: Operating area	Indian: Productivity: High	Indian: Productivity: Medium	Indian: Productivity: Low	Other Federal: Operating area	Other Federal: Productivity: High	Other Federal: Productivity: Medium	Other Federal: Productivity: Low	State, county, and municipal: Operating area	State, county, and municipal: Productivity: High	State, county, and municipal: Productivity: Medium	State, county, and municipal: Productivity: Low
	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent
North:																								
New England	1,356	95	2	3	806	97	3	..	..	..	..	..	..	..	..	..	11	9	..	91	539	93	1	6
Middle Atlantic	3,191	93	6	1	1,177	98	2	..	..	..	..	..	..	..	..	..	62	39	61	..	1,952	92	7	1
Lake States	16,001	80	19	1	5,082	77	22	1	45	..	100	..	803	96	3	1	106	59	11	30	9,965	81	19	(2/)
Central	2,379	89	11	(2/)	1,829	89	11	..	..	..	..	..	..	..	..	..	137	64	36	..	413	94	6	(2/)
Plains	29	28	55	17	8	100	..	..	..	..	..	..	16	..	69	31	..	..	..	..	5	..	100	..
Total	22,956	83	16	1	8,902	84	16	(2/)	45	..	100	..	819	94	4	2	316	56	31	13	12,874	83	16	1
South:																								
South Atlantic	3,316	91	7	2	2,544	94	6	..	..	..	..	..	45	100	..	..	410	73	15	12	317	92	7	1
Southeast	5,473	90	8	2	3,407	95	3	2	..	..	..	..	..	..	..	..	1,307	90	10	..	759	70	29	1
West Gulf	2,942	73	24	3	2,603	76	24	..	13	100	..	..	..	..	..	..	207	59	37	4	119	12	28	60
Total	11,731	86	12	2	8,554	89	10	1	13	100	..	..	45	100	..	..	1,924	83	14	3	1,195	70	23	7
West:																								
Pacific Northwest:																								
D.-fir subregion	8,667	87	11	2	4,380	92	8	..	2,020	86	14	..	195	82	17	1	52	100	..	..	2,020	78	13	9
Pine subregion	9,898	85	14	1	6,980	89	10	1	285	75	25	..	2,140	83	17	..	30	43	57	..	463	39	45	16
Total	18,565	86	12	2	11,360	90	10	(2/)	2,305	85	15	..	2,335	83	17	(2/)	82	79	21	..	2,483	70	19	11
California	5,343	74	26	..	5,093	75	25	..	118	30	70	..	73	100	..	..	..	..	..	..	59	100	..	..
Northern Rocky Mtn.	20,856	66	24	10	18,312	68	22	10	673	68	24	8	501	52	42	6	..	..	..	..	1,370	36	47	17
Southern Rocky Mtn.	12,082	80	18	2	9,973	85	15	(2/)	670	64	7	29	1,242	53	47	..	43	95	5	..	154	49	18	33
Total	56,846	76	19	5	44,738	79	17	4	3,766	76	17	7	4,151	70	29	1	125	85	15	..	4,066	58	28	14
Continental U. S.	91,533	79	17	4	62,194	81	16	3	3,824	76	18	6	5,015	74	25	1	2,365	80	16	4	18,135	77	19	4
Coastal Alaska	4,224	89	11	..	3,443	87	13	..	781	100	..	..	..	..	..	..	..	..	..	..	..	..	..	..
All Regions	95,757	80	17	3	65,637	81	16	3	4,605	80	15	5	5,015	74	25	1	2,365	80	16	4	18,135	77	19	4

Section and region	All private: Operating area	All private: Productivity: High	All private: Productivity: Medium	All private: Productivity: Low	Small private holdings: Under 100 acres[3]: Operating area	Under 100 acres: High	Under 100 acres: Medium	Under 100 acres: Low	Small private holdings: 100 to 500 acres: Operating area	100 to 500 acres: High	100 to 500 acres: Medium	100 to 500 acres: Low	Small private holdings: 500 to 5,000 acres: Operating area	500 to 5,000 acres: High	500 to 5,000 acres: Medium	500 to 5,000 acres: Low	Medium private holdings (5,000 to 50,000 acres): Operating area	Medium private holdings: High	Medium private holdings: Medium	Medium private holdings: Low	Large private holdings (50,000 and larger): Operating area	Large private holdings: High	Large private holdings: Medium	Large private holdings: Low
	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent
North:																								
New England	13,684	60	32	8	1,355	36	42	22	2,006	40	38	22	479	22	40	38	1,766	70	23	7	8,078	69	30	1
Middle Atlantic	11,088	58	28	14	3,147	59	32	9	2,343	58	32	10	1,525	50	10	40	2,227	55	32	13	1,846	65	28	7
Lake States	7,938	69	23	8	2,150	57	28	15	1,988	60	33	7	516	72	5	23	804	70	24	6	2,480	87	13	(2/)
Central	8,761	45	41	14	3,421	42	43	15	3,004	50	38	12	1,182	38	36	26	829	46	49	5	325	37	50	13
Plains	64	6	28	66	64	6	28	66	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	41,535	58	31	11	10,137	50	36	14	9,341	52	35	13	3,702	46	21	33	5,626	61	[illegible]	9	12,729	71	27	2
South:																								
South Atlantic	14,648	58	30	12	3,688	41	41	18	4,650	45	36	19	1,538	44	50	6	2,056	84	15	1	2,716	89	7	4
Southeast	41,471	53	25	22	6,049	25	32	43	10,352	37	29	34	7,792	41	38	21	7,412	63	24	13	9,866	86	[illegible]	6
West Gulf	19,567	42	36	22	3,495	19	47	34	4,575	21	46	33	1,479	21	37	42	3,266	48	37	15	6,752	70	21	9
Total	75,686	51	29	20	13,232	27	[illegible]	34	19,577	35	35	30	10,809	39	40	21	12,734	63	26	11	19,334	81	13	6
West:																								
Pacific Northwest:																								
D.-fir subregion	9,273	79	15	6	588	59	34	7	1,288	57	27	16	1,273	63	27	10	1,775	75	16	9	4,349	94	4	2
Pine subregion	3,324	62	32	6	55	25	44	31	543	18	63	19	969	46	45	9	442	64	36	..	1,315	94	6	..
Total	12,597	75	19	6	643	56	34	10	1,831	46	38	16	2,242	56	35	9	2,217	73	20	7	5,664	94	5	1
California	3,722	81	17	2	40	55	20	25	198	40	43	17	554	64	29	7	1,433	87	13	..	1,497	87	13	..
Northern Rocky Mtn.	3,972	39	48	13	68	21	51	28	615	12	59	29	645	41	48	11	296	49	33	18	2,348	45	46	9
Southern Rocky Mtn.	1,608	59	30	11	10	20	70	10	151	35	58	7	379	56	35	9	293	34	23	43	775	76	24	..
Total	21,899	68	25	7	761	52	36	12	2,795	37	44	19	3,820	55	36	9	4,239	73	19	8	10,284	80	17	3
Continental U. S.	4/ 139,120	56	29	15	24,130	38	37	25	31,713	40	36	24	18,331	44	35	21	22,599	64	26	10	42,347	78	18	4

Section and region	Farm: Operating area	Farm: Productivity: High	Farm: Productivity: Medium	Farm: Productivity: Low	Lumber manufacturer[5]: Operating area	Lumber manufacturer: High	Lumber manufacturer: Medium	Lumber manufacturer: Low	Pulp manufacturer: Operating area	Pulp manufacturer: High	Pulp manufacturer: Medium	Pulp manufacturer: Low	All wood-using industries[6]: Operating area	All wood-using industries: High	All wood-using industries: Medium	All wood-using industries: Low	Other private: Operating area	Other private: High	Other private: Medium	Other private: Low	All ownerships: Operating area	All ownerships: High	All ownerships: Medium	All ownerships: Low
	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent
North:																								
New England	2,173	42	39	19	538	..	..	..	5,322	56	43	1	6,037	54	41	5	5,474	74	19	7	15,040	63	29	8
Middle Atlantic	4,235	62	29	9	713	..	..	..	755	100	..	..	1,549	86	13	1	5,304	47	32	21	14,279	66	23	11
Lake States	3,341	59	29	12	815	..	..	..	920	98	2	(2/)	1,802	93	7	(2/)	2,795	66	25	9	23,939	77	20	3
Central	5,828	45	42	13	297	..	..	..	..	..	..	..	537	46	54	(2/)	2,396	44	34	22	11,140	54	35	11
Plains	64	6	28	66	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	93	13	36	51
Total	15,641	52	35	13	2,363	68	24	8	6,997	66	33	1	9,925	66	31	3	15,969	59	27	14	64,491	67	26	7
South:																								
South Atlantic	7,958	45	38	17	1,871	..	..	..	1,895	98	..	2	4,023	81	15	4	2,667	60	32	8	17,964	64	26	10
Southeast	18,824	35	34	31	4,213	..	..	..	5,392	99	1	..	11,207	88	9	3	11,440	46	28	26	46,944	57	23	20
West Gulf	5,784	18	51	31	5,665	..	..	..	1,633	82	18	(2/)	7,593	69	24	7	6,190	32	34	34	22,509	46	34	20
Total	32,566	34	38	28	11,749	69	23	8	8,920	96	4	(2/)	22,823	81	15	4	20,297	44	30	26	87,417	55	27	18
West:																								
Pacific Northwest																								
D.-fir subregion	1,480	53	34	13	4,434	..	..	..	1,371	95	(2/)	5	6,029	89	7	4	1,764	67	23	10	17,940	83	13	4
Pine subregion	1,320	38	52	10	1,493	..	..	..	60	80	20	..	1,553	88	12	..	451	44	40	16	13,222	79	18	3
Total	2,800	46	42	12	5,927	..	..	..	1,431	94	1	5	7,582	89	8	3	2,215	62	27	11	31,162	81	15	4
California	543	61	33	6	2,093	..	..	..	54	100	..	..	2,243	87	12	1	936	79	19	2	9,065	77	22	1
Northern Rocky Mtn.	485	15	61	24	1,791	..	..	..	..	..	..	..	1,865	33	57	10	1,622	53	34	13	24,828	62	27	11
Southern Rocky Mtn.	943	56	33	11	135	..	..	..	..	..	..	..	135	79	18	3	530	61	27	12	13,690	78	19	3
Total	4,771	46	42	12	9,946	78	19	3	1,485	94	1	5	11,825	80	16	4	5,303	62	27	11	78,745	74	21	5
Continental United States	52,978	41	37	22	24,058	73	21	6	17,402	84	15	1	44,573	77	19	4	41,569	52	28	20	230,653	65	24	11
Coastal Alaska	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4,224	89	11	..
All Regions	52,978	41	37	22	24,058	73	21	6	17,402	84	15	1	44,573	77	19	4	41,569	[illegible]	28	20	4/ 234,877	65	24	11

1/ Prepared by Forest Service, U. S. Department of Agriculture. The determination of size class of private ownership was based on the total commercial forest land area in the ownership. The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Productivity is expressed as a percentage of operating area found to be in a high, medium, or low productivity class.

2/ Less than 0.5 percent.

3/ Includes ownerships containing 3 to 100 acres of commercial forest land in the East and 10 to 100 acres in the West.

4/ Excludes 1,537 thousand acres of commercial forest land in large private ownerships on which access was denied. The proportion of this area in operating status is not known.

5/ Productivity ratings are omitted on a regional basis because sampling of small ownerships, which make up a large share of the total, was not adequate to provide valid estimates for region breakdowns.

6/ Includes lumber, pulp and all other wood-using industries combined.

Table 71.--Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by stand-size class, and by section, region, and ownership class, 1953[1]

NORTH

Region and ownership class[2]	Sawtimber: Operating area	Sawtimber: Productivity			Poletimber: Operating area	Poletimber: Productivity			Seedlings and saplings: Operating area	Seedlings and saplings: Productivity		
		High	Medium	Low		High	Medium	Low		High	Medium	Low
	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent
New England:												
Small private	216	90	4	6	1,498	39	39	22	2,126	27	47	26
Medium and large private	374	100	..	..	4,354	98	2	(3/)	5,116	34	64	2
National forest	641	100	..	..	122	100	..	..	43	100	..	..
Other public	28	100	..	..	352	78	22	..	170	69	..	31
Total or average	1,259	98	1	1	6,326	81	13	6	7,455	31	58	11
Middle Atlantic:												
Small private	819	75	24	1	3,506	71	23	6	2,690	33	33	34
Medium and large private	247	79	21	..	1,833	65	26	9	1,993	53	34	13
National forest	1,112	100	..	..	65	100	..	..	..	..	..	..
Other public	259	42	58	..	1,037	100	..	..	718	90	1	9
Total or average	2,437	82	18	(3/)	6,441	75	19	6	5,401	49	28	23
Lake States:												
Small private	982	74	20	6	1,606	59	32	9	2,066	50	29	21
Medium and large private[4]	1,037	100	..	..	676	83	17	..	1,571	66	33	1
National forest	426	100	..	..	2,060	88	12	..	2,596	72	28	..
Other public	329	100	..	..	3,706	96	4	..	6,884	84	16	(3/)
Total or average	2,774	90	8	2	8,048	85	13	2	13,117	73	23	4
Central:												
Small private	2,134	66	31	3	4,321	40	43	17	1,152	26	43	31
Medium and large private	248	81	19	..	670	28	64	8	236	47	47	6
National forest	756	78	22	..	1,073	99	1	..	..	..	..	..
Other public	315	93	7	..	165	98	2	..	70	25	71	4
Total or average	3,453	72	26	2	6,229	51	36	13	1,458	29	45	26
Plains:												
Small private	23	12	53	35	..	..	..	..	41	..	..	100
Medium and large private	..	..	..	..	..	..	..	..	..	..	..	..
National forest	..	..	..	..	8	100	..	..	..	..	..	..
Other public	..	..	..	..	6	..	100	..	15	..	75	25
Total or average	23	12	53	35	14	79	21	..	56	..	19	81
Total, North:												
Small private	4,174	71	25	4	10,931	52	35	13	8,075	35	37	28
Medium and large private[4]	1,906	95	5	..	7,533	83	14	3	8,916	44	52	4
National forest	2,935	94	6	..	3,328	92	8	..	2,639	72	28	..
Other public	931	82	18	..	5,266	96	4	..	7,857	84	15	1
Total or average	9,946	83	15	2	27,058	74	20	6	27,487	55	35	10

SOUTH

Region and ownership class[2]	Sawtimber: Operating area	Sawtimber: High	Sawtimber: Medium	Sawtimber: Low	Poletimber: Operating area	Poletimber: High	Poletimber: Medium	Poletimber: Low	Seedlings and saplings: Operating area	Seedlings and saplings: High	Seedlings and saplings: Medium	Seedlings and saplings: Low
South Atlantic:												
Small private	967	57	35	8	3,606	48	35	17	5,303	45	37	18
Medium and large private[4]	574	100	..	..	1,560	73	27	..	2,638	94	6	..
National forest	513	100	..	..	1,842	100	..	..	189	100	..	..
Other public	148	100	..	..	261	96	4	..	363	57	42	1
Total or average	2,202	80	16	4	7,269	67	24	9	8,493	61	28	11
Southeast:												
Small private	784	72	15	13	8,804	38	30	32	14,605	27	33	40
Medium and large private[4]	1,959	93	6	1	8,164	68	24	8	7,155	81	10	9
National forest	720	100	..	..	2,217	100	..	..	470	68	32	..
Other public	702	96	4	..	810	94	6	..	554	69	31	..
Total or average	4,165	90	7	3	19,995	59	23	18	22,784	46	26	28
West Gulf:												
Small private	696	22	69	9	2,716	30	36	34	6,137	15	41	44
Medium and large private[4]	5,430	86	12	2	2,522	47	27	26	2,066	48	37	15
National forest	2,076	93	7	..	400	100	..	..	127	100	..	..
Other public	82	54	46	..	45	..	21	79	212	41	30	29
Total or average	8,284	82	16	2	5,683	42	29	29	8,542	26	39	35
Total, South:												
Small private	2,447	51	39	10	15,126	38	33	29	26,045	28	36	36
Medium and large private[4]	7,963	88	10	2	12,246	63	25	12	11,859	77	15	8
National forest	3,309	95	5	..	4,459	100	..	..	786	81	19	..
Other public	932	91	9	..	1,116	88	7	5	1,129	58	34	8
Total or average	14,651	84	13	3	32,947	57	25	18	39,819	44	29	27

Table 71.--Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by stand-size class, and by section, region, and ownership class, 1953[1/] - Continued

WEST

Region and ownership class[2/]	Sawtimber				Poletimber				Seedlings and saplings			
	Operating area	Productivity			Operating area	Productivity			Operating area	Productivity		
		High	Medium	Low		High	Medium	Low		High	Medium	Low
	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent
Pacific Northwest:												
Douglas-fir subregion:												
Small private	124	48	30	22	275	58	38	4	2,750	62	27	11
Medium and large private	305	100	..	..	13	93	7	..	5,806	89	7	4
National forest	376	100	..	..	..	..	..	..	4,004	93	7	..
Other public	30	88	12	..	27	46	..	54	4,230	85	15	(3/)
Total or average	835	93	4	3	315	58	34	8	16,790	85	12	3
Pine subregion:												
Small private	529	47	32	21	365	50	39	11	673	29	61	10
Medium and large private	880	89	11	..	148	67	33	..	729	75	25	..
National forest	6,087	92	7	1	..	..	..	..	893	77	23	..
Other public	2,155	90	10	..	154	28	71	1	609	70	20	10
Total or average	9,651	89	9	2	667	49	45	6	2,904	65	31	4
Total, Pacific Northwest:												
Small private	653	47	32	21	640	54	38	8	3,423	55	34	11
Medium and large private	1,185	92	8	..	161	69	31	..	6,535	88	9	3
National forest	6,463	93	6	1	..	..	..	..	4,897	90	10	..
Other public	2,185	90	10	..	181	30	62	8	4,839	83	15	2
Total or average	10,486	90	9	1	982	52	42	6	19,694	82	15	3
California:												
Small private	178	60	25	15	200	31	48	21	414	69	27	4
Medium and large private[4/]	1,088	85	15	..	208	73	27	..	1,634	89	11	..
National forest	4,112	74	26	..	103	45	55	..	878	95	5	..
Other public	103	45	55	..	..	..	..	..	147	83	17	..
Total or average	5,481	75	25	(3/)	511	51	42	7	3,073	88	11	1
Northern Rocky Mountain:												
Small private	586	16	72	12	549	29	56	15	193	31	36	33
Medium and large private	1,924	57	40	3	495	4	96	..	225	..	7	93
National forest	15,290	70	23	7	469	100	..	..	2,553	63	(3/)	37
Other public	1,854	57	40	3	596	26	42	32	94	77	..	23
Total or average	19,654	66	28	6	2,109	38	48	14	3,065	57	3	40
Southern Rocky Mountain:												
Small private	94	8	83	9	189	54	39	7	257	59	33	8
Medium and large private	284	56	33	11	684	84	6	10	100	25	75	..
National forest	6,174	83	17	(3/)	1,459	79	21	..	2,340	85	15	..
Other public	1,121	54	45	1	275	72	14	14	713	76	..	24
Total or average	7,673	77	22	1	2,607	78	17	5	3,410	80	15	5
Total, West:												
Small private	1,511	34	49	17	1,578	42	46	12	4,287	55	34	11
Medium and large private[4/]	4,481	73	25	2	1,548	56	39	5	8,494	85	10	5
National forest	32,039	78	19	3	2,031	82	18	..	10,668	83	9	8
Other public	5,263	70	29	1	1,052	39	38	23	5,793	82	13	5
Total or average	43,294	75	22	3	6,209	59	33	6	29,242	80	13	7

ALL REGIONS

Region and ownership class	Sawtimber operating area	High	Medium	Low	Poletimber operating area	High	Medium	Low	Seedlings and saplings operating area	High	Medium	Low
Continental United States:												
Small private	8,132	58	34	8	27,635	44	34	22	38,407	32	36	32
Medium and large private[4/]	14,350	85	13	2	21,327	70	22	8	29,269	69	25	6
National forest	38,283	81	16	3	9,818	93	7	..	14,093	81	13	6
Other public	7,126	74	25	1	7,434	87	9	4	14,779	81	16	3
Total or average	67,891	78	19	3	66,214	64	24	12	96,548	57	26	17
Coastal Alaska:[5/]												
National forest	..	..	..	..	..	..	..	..	3,443	87	13	..
Other public	..	..	..	..	..	..	..	..	781	100	..	..
Total or average	..	..	..	..	..	..	..	..	4,224	89	11	..
Total, all regions:												
Small private	8,132	58	34	8	27,635	44	34	22	38,407	32	36	32
Medium and large private[4/]	14,350	85	13	2	21,327	70	22	8	29,269	69	25	6
National forest	38,283	81	16	3	9,818	93	7	..	17,536	82	13	5
Other public	7,126	74	25	1	7,434	87	9	4	15,560	81	15	4
Total or average	67,891	78	19	3	66,214	64	24	12	100,772	58	26	16

1/ Prepared by Forest Service, U. S. Department of Agriculture. The determination of size class of private ownership was based on the total commercial forest land area in the ownership. The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Productivity is expressed as a percentage of operating area found to be in a high, medium, or low productivity class.

2/ Small private includes ownerships containing 3 to 5,000 acres of commercial forest land in the East and 10 to 5,000 acres in the West. Medium and large private includes ownerships of 5,000 acres and larger.

3/ Less than 0.5 percent.

4/ Excludes operating area on some large private ownerships on which access was denied.

5/ Certain classes of private ownership were omitted in this region because there were no ownerships of the omitted classes or they were so small that total operating area by stand-size class could not be adequately determined by sampling procedures.

Table 72.--Productivity of recently cut privately owned commercial forest land in continental United States, by type of ownership and size class, and by section, 1953 1/

Section and type of ownership	All classes				Small private holdings: Under 100 acres 2/				Small private holdings: 100 to 500 acres				Small private holdings: 500 to 5,000 acres				Medium private holdings: 5,000 to 50,000 acres				Large private holdings: 50,000 acres and larger			
	Operating area	Productivity: High	Productivity: Medium	Productivity: Low	Operating area	Productivity: High	Productivity: Medium	Productivity: Low	Operating area	Productivity: High	Productivity: Medium	Productivity: Low	Operating area	Productivity: High	Productivity: Medium	Productivity: Low	Operating area	Productivity: High	Productivity: Medium	Productivity: Low	Operating area	Productivity: High	Productivity: Medium	Productivity: Low
	Thousand acres	Pct.	Pct.	Pct.	Thousand acres	Pct.	Pct.	Pct.	Thousand acres	Pct.	Pct.	Pct.	Thousand acres	Pct.	Pct.	Pct.	Thousand acres	Pct.	Pct.	Pct.	Thousand acres	Pct.	Pct.	Pct.
North:																								
Farm	15,641	52	35	13	7,670	50	38	12	6,717	55	35	10	1,170	41	25	34	84	100	..	..	..	..	..	..
Lumber manufacturer	2,363	68	24	8	90	59	31	10	242	41	34	25	578	60	23	17	800	64	32	4	653	90	10	..
Pulp manufacturer	6,997	66	33	1	..	..	..	..	..	..	..	..	..	..	..	..	604	81	17	2	6,393	65	34	1
Other wood manufacturer	565	53	38	9	..	..	..	..	1	..	100	..	9	100	..	..	265	56	25	19	290	48	52	..
Other private	15,969	59	27	14	2,377	48	31	21	2,381	45	36	19	1,945	44	19	37	3,873	56	34	10	5,393	78	19	3
Total or average	41,535	58	31	11	10,137	50	36	14	9,341	52	35	13	3,702	46	21	33	5,626	61	30	9	12,729	71	27	2
South:																								
Farm	32,566	34	38	28	10,368	26	40	34	13,995	36	34	30	6,604	40	43	17	1,599	52	30	18	..	..	..	..
Lumber manufacturer	11,749	69	23	8	51	30	35	35	617	25	58	17	469	59	20	21	4,263	70	22	8	6,349	75	20	5
Pulp manufacturer	8,920	96	4	(3/)	..	..	..	..	..	..	..	..	85	24	76	..	172	100	..	..	8,663	96	3	1
Other wood manufacturer	2,154	78	22	(3/)	..	..	..	..	37	..	100	..	34	100	..	..	1,574	72	27	1	509	100	..	..
Other private	20,297	44	30	26	2,813	34	31	35	4,928	35	33	32	3,617	34	35	31	5,126	56	28	16	3,813	54	23	23
Total or average	75,686	51	29	20	13,232	27	39	34	19,577	35	35	30	10,809	39	40	21	12,734	63	26	11	19,334	81	13	6
West:																								
Farm	4,771	46	42	12	473	54	38	8	1,411	29	54	17	2,071	48	41	11	471	56	30	14	345	84	16	..
Lumber manufacturer	9,946	78	19	3	10	30	..	70	107	32	50	18	783	56	33	11	2,588	82	13	5	6,458	79	20	1
Pulp manufacturer	1,485	94	1	5	..	..	..	..	..	..	..	..	6	..	50	50	190	58	6	36	1,289	100	..	..
Other wood manufacturer	394	73	9	18	..	..	..	..	2	100	..	..	35	80	20	..	283	91	9	..	74	..	7	93
Other private	5,303	62	27	11	278	51	33	16	1,275	48	32	20	925	67	38	5	707	48	41	11	2,118	75	19	6
Total or average	21,899	68	25	7	761	52	36	12	2,795	37	44	19	3,820	55	36	9	4,239	73	19	8	10,284	80	17	3
Continental United States:																								
Farm	52,978	41	37	22	18,511	37	39	24	22,123	41	36	23	9,845	42	40	18	2,154	55	29	16	345	84	16	..
Lumber manufacturer	24,058	73	21	6	151	47	30	23	966	30	51	19	1,830	58	27	15	7,651	74	20	6	13,460	78	19	3
Pulp manufacturer	17,402	84	15	1	..	..	..	..	..	..	..	..	91	22	75	3	966	79	12	9	16,345	84	15	1
Other wood manufacturer	3,113	73	23	4	..	..	..	..	40	5	95	..	78	91	9	..	2,122	73	24	3	873	74	18	8
Other private	41,569	52	28	20	5,468	41	31	28	8,584	40	33	27	6,487	42	29	29	9,706	56	31	13	11,324	69	21	10
Total or average 4/	139,120	56	29	15	24,130	38	37	25	31,713	40	36	24	18,331	44	35	21	22,599	64	26	10	42,347	78	18	4

1/ Prepared by Forest Service, U. S. Department of Agriculture. The determination of size class of private ownership was based on the total commercial forest land area in the ownership. The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Productivity is expressed as a percentage of operating area found to be in a high, medium or low productivity class.

2/ Includes ownerships containing 3 to 100 acres of commercial forest land in the East and 10 to 100 acres in the West.

3/ Less than 0.5 percent.

4/ Excludes 1,537 thousand acres of commercial forest land in large private ownerships on which access was denied. The proportion of this in operating States is not known.

Table 73.--Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by size class of primary forest products harvested and by section, region, and ownership class, 1953 1/

NORTH

Region and ownership class 2/	Large products 3/				Both large and small products 5/				Small products 4/			
	Operating area	Productivity			Operating area	Productivity			Operating area	Productivity		
		High	Medium	Low		High	Medium	Low		High	Medium	Low
	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent
New England:												
Small private	1,941	35	34	31	695	28	61	11	1,204	41	42	17
Medium and large private	1,141	74	17	9	1,170	82	16	2	7,533	60	40	(6/)
National forest	723	100	..	..	33	100	..	..	50	100	..	..
Other public	329	77	23	..	69	100	..	..	152	94	..	6
Total or average	4,134	57	24	19	1,967	61	34	5	8,939	58	39	3
Middle Atlantic:												
Small private	4,209	66	28	6	1,320	46	39	15	1,486	40	13	47
Medium and large private	1,674	59	40	1	1,276	61	30	9	1,123	60	14	26
National forest	247	100	..	..	930	100	..	..	..	..	..	..
Other public	1,297	88	12	..	637	100	..	..	80	21	..	79
Total or average	7,427	70	27	3	4,163	72	21	7	2,689	48	13	39
Lake States:												
Small private	1,515	55	29	16	1,010	56	39	5	2,129	61	23	16
Medium and large private 7/	1,254	82	18	..	788	80	20	..	1,242	78	21	1
National forest	..	..	..	..	4,813	80	20	..	269	100	..	..
Other public	276	100	..	..	7,641	88	12	..	3,002	88	12	(6/)
Total or average	3,045	70	22	8	14,252	82	17	1	6,642	77	17	6
Central:												
Small private	5,434	47	43	10	1,649	45	29	26	524	31	41	28
Medium and large private	918	47	47	6	220	32	61	7	16	..	100	..
National forest	1,292	86	14	..	537	100	..	..	..	..	..	..
Other public	419	85	15	..	118	100	..	..	13	..	79	21
Total or average	8,063	55	37	8	2,524	58	24	18	553	30	43	27
Plains:												
Small private	26	11	49	40	37	..	..	100	1	..	..	100
Medium and large private	..	..	..	..	..	..	..	..	..	..	..	..
National forest	..	..	..	..	..	..	..	..	8	100	..	..
Other public	6	..	100	..	11	..	100	..	4	..	..	..
Total or average	32	9	58	33	48	..	22	78	13	81	..	19
Total, North:												
Small private	13,125	51	35	14	4,711	44	39	17	5,344	49	27	24
Medium and large private 7/	4,987	68	29	3	3,454	72	24	4	9,914	63	34	3
National forest	2,262	92	8	..	6,313	84	16	..	327	100	..	..
Other public	2,327	87	13	..	8,476	89	11	..	3,251	86	11	3
Total or average	22,701	62	29	9	22,954	76	20	4	18,836	63	28	9

SOUTH

Region and ownership class 2/	Large: Operating area	High	Medium	Low	Both: Operating area	High	Medium	Low	Small: Operating area	High	Medium	Low
South Atlantic:												
Small private	6,494	41	40	19	1,394	55	32	13	1,988	61	27	12
Medium and large private 7/	2,471	83	17	..	886	82	18	..	1,415	100	..	..
National forest	1,205	100	..	..	1,153	100	..	..	186	100	..	..
Other public	316	85	14	1	316	62	38	..	140	100	..	..
Total or average	10,486	58	30	12	3,749	75	20	5	3,729	78	15	7
Southeast:												
Small private	15,266	34	34	32	4,224	37	33	30	4,703	23	23	54
Medium and large private 7/	8,529	65	27	8	4,530	90	7	3	4,219	85	4	11
National forest	1,568	100	..	..	1,839	92	8	..	..	..	..	..
Other public	1,232	92	8	..	759	81	19	..	75	95	5	..
Total or average	26,595	51	28	21	11,352	70	18	12	8,997	53	14	33
West Gulf:												
Small private	6,039	19	48	33	2,007	19	32	49	1,503	23	32	45
Medium and large private 7/	6,722	59	26	15	2,540	92	7	1	756	78	13	9
National forest	1,226	88	12	..	1,377	100	..	..	..	..	..	..
Other public	160	47	15	38	179	21	74	5	..	..	..	..
Total or average	14,147	44	34	22	6,103	68	15	17	2,259	42	26	32
Total, South:												
Small private	27,799	32	38	30	7,625	35	33	32	8,194	32	26	42
Medium and large private 7/	17,722	65	25	10	7,956	90	8	2	6,390	87	5	8
National forest	3,999	96	4	..	4,369	97	3	..	186	100	..	..
Other public	1,708	82	10	8	1,254	68	31	1	215	98	2	..
Total or average	51,228	50	30	20	21,204	70	17	13	14,985	57	16	27

Table 73.--Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by size class of primary forest products harvested and by section, region, and ownership class, 1953[1/] - Continued

WEST

Region and ownership class[2/]	Large products[3/]: Operating area	Large products: Productivity: High	Large products: Productivity: Medium	Large products: Productivity: Low	Both large and small products[5/]: Operating area	Both: Productivity: High	Both: Productivity: Medium	Both: Productivity: Low	Small products[4/]: Operating area	Small: Productivity: High	Small: Productivity: Medium	Small: Productivity: Low
	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent	Thousand acres	Percent	Percent	Percent
Pacific Northwest:												
Douglas-fir subregion:												
Small private	2,829	61	28	11	205	64	30	6	115	64	23	13
Medium and large private	5,894	91	7	2	221	67	..	33	9	100	..	..
National forest	4,328	93	7	..	52	100	..	..	..	..	..	..
Other public	4,170	85	15	(6/)	102	99	..	1	15	6	..	94
Total or average	17,221	86	12	2	580	75	10	15	139	60	19	21
Pine subregion:												
Small private	1,465	37	48	15	..	..	..	..	102	88	12	..
Medium and large private	1,757	82	18	..	..	..	..	..	..	..	..	..
National forest	6,840	90	9	1	140	100	..	..	..	..	..	..
Other public	2,918	82	16	2	..	..	..	..	..	..	..	..
Total or average	12,980	82	16	2	140	100	..	..	102	88	12	..
Total, Pacific Northwest:												
Small private	4,294	52	35	13	205	64	30	6	217	75	18	7
Medium and large private	7,651	88	10	2	221	67	..	33	9	100	..	..
National forest	11,168	92	8	(6/)	192	100	..	..	..	..	..	..
Other public	7,088	84	15	1	102	99	..	1	15	6	..	94
Total or average	30,201	84	14	2	720	80	8	12	241	72	16	12
California:												
Small private	716	57	31	12	66	61	39	..	10	20	80	..
Medium and large private[7/]	2,786	87	13	..	144	81	19	..	..	..	..	..
National forest	5,093	77	23	..	..	..	..	..	..	..	..	..
Other public	250	68	32	..	..	..	..	..	..	..	..	..
Total or average	8,845	78	21	1	210	75	25	..	10	20	80	..
Northern Rocky Mountain:												
Small private	1,238	25	61	14	2	..	100	..	88	..	50	50
Medium and large private	2,461	38	51	11	..	..	..	..	183	100	..	..
National forest	16,728	71	17	12	1,577	59	41	..	7	100	..	..
Other public	2,415	48	41	11	129	100	..	..	..	..	..	..
Total or average	22,842	63	25	12	1,708	62	38	..	278	70	15	15
Southern Rocky Mountain:												
Small private	346	33	55	12	4	100	..	..	190	75	25	..
Medium and large private	962	68	21	11	106	100	..	..	..	..	..	..
National forest	9,407	84	16	(6/)	566	70	30	..	..	..	..	..
Other public	2,109	64	26	10	..	..	..	..	..	..	..	..
Total or average	12,824	78	19	3	676	75	25	..	190	75	25	..
Total, West:												
Small private	6,594	46	41	13	277	64	32	4	505	62	27	11
Medium and large private[7/]	13,860	77	19	4	471	79	6	15	192	100	..	..
National forest	42,396	80	15	5	2,335	65	35	..	7	100	..	..
Other public	11,862	72	23	5	231	100	..	(6/)	15	6	..	94
Total or average	74,712	76	19	5	3,314	70	28	2	719	72	18	10

ALL REGIONS

Region and ownership class	Large: Operating area	Large: High	Large: Medium	Large: Low	Both: Operating area	Both: High	Both: Medium	Both: Low	Small: Operating area	Small: High	Small: Medium	Small: Low
Continental United States:												
Small private	47,518	39	38	23	12,613	39	35	26	14,043	40	26	34
Medium and large private[7/]	36,569	69	24	7	11,881	85	12	3	16,496	73	22	5
National forest	48,657	82	14	4	13,017	85	15	..	520	100	..	..
Other public	15,897	76	20	4	9,961	87	13	(6/)	3,481	86	11	3
Total or average	148,641	65	24	11	47,472	73	19	8	34,540	61	22	17
Coastal Alaska:[8/]												
National forest	3,443	87	13	..	..	..	..	..	..	..	..	..
Other public	781	100	..	..	..	..	..	..	..	..	..	..
Total or average	4,224	89	11	..	..	..	..	..	..	..	..	..
Total, all regions:												
Small private	47,518	39	38	23	12,613	39	35	26	14,043	40	26	34
Medium and large private[7/]	36,569	69	24	7	11,881	85	12	3	16,496	73	22	5
National forest	52,100	82	14	4	13,017	85	15	..	520	100	..	..
Other public	16,678	77	19	4	9,961	87	13	(6/)	3,481	86	11	3
Total or average	152,865	65	24	11	47,472	73	19	8	34,540	61	22	17

1/ Prepared by Forest Service, U. S. Department of Agriculture. The determination of size class of private ownership was based on the total commercial forest land area in the ownership. The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Productivity is expressed as a percentage of operating area found to be in a high, medium, or low productivity class.

2/ Small private includes ownerships containing 3 to 5,000 acres of commercial forest land in the East and 10 to 5,000 acres in the West. Medium and large private includes ownerships of 5,000 and larger.

3/ Cuttings on which large products like sawlogs, veneer logs, pulp logs, veneer bolts, or stave bolts comprise 80 percent or more of the total cubic-foot volume of products harvested.

4/ Cuttings on which small products consisting of such cordwood products as pulpwood, distillation wood, fuelwood, feltwood, etc., comprise 80 percent or more of the total cubic-foot volume of products harvested.

5/ Cuttings on which both large and small products are harvested together.

6/ Less than 0.5 percent.

7/ Excludes operating area on some large private ownerships on which access was denied.

8/ Certain classes of private ownerships were omitted in this region because there were no ownerships of the omitted classes or they were so small that total operating area by product class could not be adequately determined by sampling procedures.

Table 74.--Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by region, forest type group, and ownership class, and by elements of the combined productivity class, 1953[1]

NEW ENGLAND

Forest type group and ownership class	Operating area	Productivity: By combined productivity class			By existing stocking, all species			By existing stocking plus prospective stocking all species[2]			Existing and prospective stocking modified by composition			Proportion of total on which felling age factors were applied
		High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	
	Thousand acres	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Small private ownerships (3 to 5,000 acres):														
White-red-jack pine	1,166	21	38	41	32	42	26	41	38	21	31	41	28	84
Spruce-fir	1,615	43	40	17	50	26	24	68	25	7	66	25	9	87
Oak-hickory	84	60	40	..	50	26	24	100	..	..	99	1	..	100
Maple-beech-birch	975	42	42	16	58	34	8	73	22	5	64	28	8	72
Medium and large private ownerships (5,000 acres and larger):														
White-red-jack-pine	281	81	14	5	88	5	7	91	5	4	84	11	5	66
Loblolly-shortleaf pine	2	..	100	..	100	..	..	100	..	..	..	100	..	100
Spruce-fir	7,228	71	28	1	86	13	1	89	11	(3/)	89	11	(3/)	80
Oak-pine	2	100	..	..	100	..	..	100	..	..	100	..	..	100
Oak-hickory	17	12	88	..	94	6	..	100	..	..	100	..	..	94
Maple-beech-birch	2,314	64	32	4	81	15	4	86	13	1	72	27	1	87
Public ownerships:														
White-red-jack pine	114	74	..	26	74	..	26	74	..	26	74	..	26	51
Loblolly-shortleaf pine	5	..	..	100	..	..	100	..	..	100	..	..	100	..
Spruce-fir	316	96	1	3	90	7	3	97	..	3	97	..	3	18
Oak-hickory	156	100	..	..	47	53	..	100	..	..	100	..	..	53
Maple-beech-birch	765	97	3	..	96	4	..	100	..	..	97	3	..	41

MIDDLE ATLANTIC

Forest type group and ownership class	Operating area	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	Proportion
Small private ownerships (3 to 5,000 acres):														
White-red-jack pine	575	71	27	2	92	7	1	98	1	1	95	4	1	70
Spruce-fir	106	79	21	..	64	35	1	84	16	..	84	16	..	48
Loblolly-shortleaf pine	397	31	26	43	30	28	42	39	24	37	36	24	40	25
Oak-pine	250	31	35	34	32	32	36	44	31	25	40	27	33	66
Oak-hickory	2,761	41	33	26	50	30	20	71	13	16	63	21	16	65
Maple-beech-birch	2,926	74	21	5	84	13	3	92	7	1	84	13	3	67
Medium and large private ownerships (5,000 acres and larger):														
White-red-jack pine	38	100	..	..	21	79	..	100	..	..	100	..	..	100
Spruce-fir	351	94	6	..	78	14	8	94	6	..	94	6	..	22
Loblolly-shortleaf pine	34	59	41	..	29	71	..	59	41	..	59	41	..	71
Oak-pine	8	12	..	88	12	12	76	12	12	76	12	..	88	..
Oak-hickory	1,851	43	41	16	26	56	18	68	25	7	50	42	8	76
Maple-beech-birch	1,791	69	25	6	49	45	6	96	4	..	85	11	4	58
Public ownerships:														
White-red-jack pine	77	26	74	..	26	74	..	26	74	..	26	74	..	6
Spruce-fir	6	..	100	..	100	..	..	100	..	..	100	..	..	100
Loblolly-shortleaf pine	25	100	..	..	96	..	4	100	..	..	100	..	..	76
Oak-pine	4	25	50	25	25	50	25	75	25	..	25	50	25	..
Oak-hickory	1,371	93	6	1	60	39	1	99	1	..	93	6	1	37
Maple-beech-birch	1,708	97	3	..	95	5	..	99	1	..	97	3	..	55

See footnotes at end of table.

Table 74.--Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by region, forest type group, and ownership class, and by elements of the combined productivity class, 1953[1] - Continued

LAKE STATES

Forest type group and ownership class	Operating area	Productivity												Proportion of total on which felling age factors were applied
		By combined productivity class			By existing stocking, all species			By existing stocking plus prospective stocking all species[2]			Existing and prospective stocking modified by composition			
		High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	
	Thousand acres	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Small private ownerships (3 to 5,000 acres):														
White-red-jack pine	433	25	54	21	17	46	37	33	53	14	27	56	17	27
Spruce-fir	560	34	47	19	27	49	24	67	28	5	49	42	9	58
Oak-hickory	622	49	39	12	64	20	16	71	26	3	55	37	8	34
Elm-ash-cottonwood	99	31	60	9	16	58	26	43	49	8	39	53	8	26
Maple-beech-birch	1,295	73	17	10	56	31	13	82	11	7	77	15	8	26
Aspen-birch	1,645	74	15	11	52	30	18	74	18	8	74	15	11	9
Medium and large private ownerships (5,000 acres and larger):[4]														
White-red-jack pine	249	73	24	3	29	48	23	84	15	1	73	24	3	6
Spruce-fir	581	75	21	4	20	73	7	76	24	..	76	22	2	34
Oak-hickory	6	..	100	..	..	100	..	..	100	..	..	100	..	..
Elm-ash-cottonwood	17	100	..	..	94	6	..	100	..	..	100	..	..	..
Maple-beech-birch	1,715	81	18	1	66	29	5	92	8	(3/)	84	15	1	12
Aspen-birch	716	95	2	3	73	22	5	95	2	3	95	2	3	3
Public ownerships:														
White-red-jack pine	2,505	68	30	2	27	57	16	82	18	(3/)	69	31	(3/)	13
Spruce-fir	3,997	76	24	(3/)	46	44	10	88	12	(3/)	78	22	(3/)	28
Oak-hickory	429	76	24	..	43	57	..	100	..	..	100	..	..	89
Elm-ash-cottonwood	190	30	56	14	4	69	27	58	28	14	30	56	14	..
Maple-beech-birch	2,250	91	8	1	87	10	3	91	9	..	91	8	1	9
Aspen-birch	6,630	85	15	(3/)	55	45	(3/)	90	10	..	86	14	(3/)	13

CENTRAL STATES

Forest type group and ownership class	Operating area	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	Proportion
Small private ownerships (3 to 5,000 acres):														
Loblolly-shortleaf pine	23	13	17	70	74	13	13	87	..	13	22	65	13	78
Oak-pine	460	81	18	1	79	20	1	84	15	1	81	18	1	11
Oak-hickory	6,242	43	41	16	51	35	14	71	24	5	52	34	14	39
Oak-gum-cypress	265	51	27	22	34	40	26	73	9	18	55	26	19	60
Elm-ash-cottonwood	447	39	50	11	31	64	5	85	12	3	43	57	(3/)	46
Maple-beech-birch	170	40	49	11	73	22	5	90	10	..	50	42	8	29
Medium and large private ownerships (5,000 acres and larger):														
Loblolly-shortleaf pine	12	75	25	..	67	33	..	75	25	..	75	25	..	25
Oak-pine	75	45	40	15	43	56	1	81	19	..	61	24	15	33
Oak-hickory	1,059	43	50	7	40	44	16	72	27	1	63	31	6	52
Maple-beech-birch	8	..	100	..	100	..	..	100	..	..	..	100	..	..
Public ownerships:														
White-red-jack pine	1	100	..	..	100	..	..	100	..	..	100	..	..	..
Loblolly-shortleaf pine	176	100	..	..	79	21	..	100	..	..	100	..	..	1
Oak-pine	390	83	17	..	84	15	1	99	1	..	83	17	..	7
Oak-hickory	1,766	89	11	(3/)	79	21	..	95	5	..	89	11	..	1
Oak-gum-cypress	6	17	83	..	100	..	..	100	..	..	17	83	..	..
Elm-ash-cottonwood	38	100	..	..	16	84	..	100	..	..	100	..	..	..
Maple-beech-birch	2	100	..	..	100	..	..	100	..	..	100	..	..	..

See footnotes at end of table.

Table 74.--Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by region, forest type group, and ownership class, and by elements of the combined productivity class, 1953[1] - Continued

PLAINS

Forest type group and ownership class	Operating area	Productivity												Proportion of total on which felling age factors were applied
		By combined productivity class			By existing stocking, all species			By existing stocking plus prospective stocking all species[2]			Existing and prospective stocking modified by composition			
		High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	
	Thousand acres	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Small private ownerships (3 to 5,000 acres):														
Oak-hickory	50	8	28	64	50	44	6	62	36	2	58	28	14	50
Elm-ash-cottonwood	14	..	29	71	14	86	..	14	86	..	..	43	57	14
Public ownerships:														
White-red-jack pine	8	100	..	..	100	..	..	100	..	..	100	..	..	..
Oak-hickory	5	..	..	100	100	..	..	100	..	..	100	..	..	100
Aspen-birch	16	..	100	..	56	..	44	56	44	..	..	100	..	56

SOUTH ATLANTIC

Forest type group and ownership class	Operating area	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	Proportion
Small private ownerships (3 to 5,000 acres):														
Longleaf-slash pine	614	23	31	46	12	31	57	47	20	33	34	30	36	87
Loblolly-shortleaf pine	6,815	44	39	17	48	35	17	57	33	10	52	34	14	45
Oak-pine	767	67	22	11	56	31	13	77	15	8	76	16	8	35
Oak-hickory	1,424	38	53	9	48	25	27	61	35	4	51	45	4	45
Oak-gum-cypress	256	35	65	..	16	58	26	46	54	..	39	61	..	33
Medium and large private ownerships (5,000 acres and larger):[4]														
Longleaf-slash pine	438	78	17	5	64	30	6	94	6	..	78	22	..	27
Loblolly-shortleaf pine	2,329	93	3	4	70	26	4	94	6	..	93	3	4	13
Oak-pine	517	90	10	..	88	11	1	90	10	..	90	10	..	22
Oak-hickory	712	93	5	2	68	30	2	97	1	2	93	5	2	55
Oak-gum-cypress	776	65	35	..	63	27	10	94	6	..	68	32	..	17
Public ownerships:														
Longleaf-slash pine	278	83	1	16	42	39	19	83	1	16	83	1	16	20
Loblolly-shortleaf pine	720	90	9	1	81	17	2	95	4	1	95	4	1	13
Oak-pine	362	100	(3/)	..	96	4	..	100	..	..	100	..	..	16
Oak-hickory	1,870	91	9	..	70	30	..	91	9	..	91	9	..	2
Oak-gum-cypress	86	88	6	6	32	64	4	88	12	..	88	6	6	6

See footnotes at end of table.

Table 74.--Productivity of recent cut commercial forest land in the United States and Coastal Alaska, by region, forest type group, and ownership class, and by elements of the combined productivity class, 1953[1] - Continued

SOUTHEAST

Forest type group and ownership class	Operating area[4]	Productivity: By combined productivity class: High	Medium	Low	By existing stocking, all species: High	Medium	Low	By existing stocking plus prospective stocking, all species[2]: High	Medium	Low	Existing and prospective stocking modified by composition: High	Medium	Low	Proportion of total on which felling age factors were applied
	Thousand acres	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Small private ownerships (3 to 5,000 acres):														
Longleaf-slash pine	6,586	31	32	37	10	44	46	40	29	31	40	28	32	46
Loblolly-shortleaf pine	10,213	36	27	37	46	26	28	51	27	22	50	27	23	71
Oak-pine	1,659	32	26	42	22	33	45	41	29	30	39	29	32	56
Oak-hickory	4,087	44	43	13	37	42	21	60	35	5	47	43	10	47
Oak-gum-cypress	1,648	33	47	20	23	22	55	59	25	16	40	41	19	74
Medium and large private ownerships (5,000 acres and larger):[4]														
Longleaf-slash pine	10,226	75	14	11	24	52	24	75	15	10	75	15	10	11
Loblolly-shortleaf pine	3,733	79	14	7	65	29	6	87	8	5	87	8	5	28
Oak-pine	399	71	28	1	42	52	6	72	28	(3/)	72	28	(3/)	15
Oak-hickory	1,199	78	19	3	25	63	12	86	11	3	78	19	3	21
Oak-gum-cypress	1,721	79	21	..	48	37	15	82	18	..	79	21	..	13
Public ownerships:														
Longleaf-slash pine	2,161	96	4	..	14	82	4	96	4	..	96	4	..	3
Loblolly-shortleaf pine	1,440	83	16	1	50	33	17	95	5	..	95	5	..	15
Oak-pine	669	90	5	5	49	40	11	95	..	5	90	5	5	1
Oak-hickory	964	90	7	3	43	52	5	97	3	..	92	5	3	3
Oak-gum-cypress	239	80	12	8	22	61	17	82	10	8	82	10	8	5

WEST GULF

Forest type group and ownership class	Operating area[4]	Productivity: By combined productivity class: High	Medium	Low	By existing stocking, all species: High	Medium	Low	By existing stocking plus prospective stocking, all species[2]: High	Medium	Low	Existing and prospective stocking modified by composition: High	Medium	Low	Proportion of total on which felling age factors were applied
Small private ownerships (3 to 5,000 acres):														
Longleaf-slash pine	435	10	41	49	14	25	61	15	38	47	15	38	47	30
Loblolly-shortleaf pine	4,206	21	28	51	25	29	46	30	37	33	29	37	34	69
Oak-pine	997	27	47	26	14	45	41	43	47	10	40	49	11	68
Oak-hickory	2,035	22	67	11	22	36	42	50	46	4	49	47	4	71
Oak-gum-cypress	1,876	16	60	24	16	37	47	37	52	11	30	50	20	72
Medium and large private ownerships (5,000 acres and larger):[4]														
Longleaf-slash pine	1,406	77	9	14	54	17	29	79	7	14	77	9	14	14
Loblolly-shortleaf pine	4,984	77	19	4	47	46	7	79	18	3	79	18	3	19
Oak-pine	415	44	24	32	49	20	31	63	12	25	63	12	25	46
Oak-hickory	106	28	72	..	8	92	..	37	63	..	30	70	..	53
Oak-gum-cypress	3,107	39	44	17	23	35	42	46	44	10	41	40	19	38
Public ownerships:														
Longleaf-slash pine	274	82	17	1	73	26	1	99	..	1	82	17	1	5
Loblolly-shortleaf pine	1,368	95	3	2	77	20	3	95	4	1	95	3	2	2
Oak-pine	185	94	6	..	78	20	2	94	6	..	94	6	..	..
Oak-hickory	974	45	55	..	5	66	29	45	55	..	45	55	..	..
Oak-gum-cypress	141	10	54	36	2	36	62	31	33	36	20	44	36	23

See footnotes at end of table.

Table 74.--Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by region, forest type group, and ownership class, and by elements of the combined productivity class, 1953[1/] - Continued

DOUGLAS-FIR SUBREGION

Forest type group and ownership class	Operating area	Productivity												Proportion of total on which felling age factors were applied
		By combined productivity class			By existing stocking, all species			By existing stocking plus prospective stocking all species			Existing and prospective stocking modified by composition			
		High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	
	Thousand acres	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Small private ownerships (10 to 5,000 acres):														
Douglas-fir	2,786	59	28	13	27	44	29	67	25	8	66	26	8	55
Hemlock-Sitka spruce	280	63	34	3	41	37	22	73	24	3	68	29	3	46
Ponderosa pine	41	88	12	..	44	44	12	88	12	..	88	12	..	56
Western white pine	5	100	..	..	20	80	..	100	..	..	100	..	..	..
Fir-spruce	24	46	..	54	..	96	4	100	..	..	46	..	54	..
Hardwoods	13	15	85	..	54	31	15	54	46	..	15	85	..	..
Medium and large private ownerships (5,000 acres and larger):														
Douglas-fir	4,204	86	10	4	50	41	9	86	10	4	86	10	4	13
Hemlock-Sitka spruce	1,750	95	1	4	91	5	4	95	5	..	95	5	..	30
Ponderosa pine	9	100	..	..	100	..	..	100	..	..	100	..	..	..
Fir-spruce	161	100	..	..	92	4	4	100	..	..	100	..	..	..
Public ownerships:														
Douglas-fir	6,971	85	12	3	52	46	2	86	13	1	85	14	1	17
Hemlock-Sitka spruce	1,184	94	6	(3/)	69	16	15	94	6	..	94	6	..	37
Ponderosa pine	136	100	..	..	100	..	..	100	..	..	100	..	..	..
Western white pine	3	100	..	..	100	..	..	100	..	..	100	..	..	..
Lodgepole pine	11	100	..	..	100	..	..	100	..	..	100	..	..	..
Fir-spruce	361	100	..	..	65	32	3	100	..	..	100	..	..	..
Hardwoods	1	..	100	..	..	100	..	..	100	..	..	100	..	..

PINE SUBREGION

Forest type group and ownership class	Operating area	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	Proportion
Small private ownerships (10 to 5,000 acres):														
Douglas-fir	305	47	33	20	43	43	14	62	33	5	54	38	8	75
Ponderosa pine	1,205	31	57	12	23	61	16	50	47	3	44	50	6	54
Lodgepole pine	31	94	6	..	94	..	6	94	6	..	94	6	..	..
Fir-spruce	26	73	15	12	38	62	..	73	27	..	73	15	12	..
Medium and large private ownerships (5,000 acres and larger):														
Douglas-fir	297	85	15	..	34	62	4	89	11	..	86	14	..	5
Ponderosa pine	1,337	89	11	..	66	30	4	92	8	..	89	11	..	1
Western white pine	11	..	100	..	..	91	9	..	100	..	..	100	..	9
Larch	60	33	67	..	87	..	13	87	13	..	33	67	..	..
Fir-spruce	52	100	..	..	100	..	..	100	..	..	100	..	..	..
Public ownerships:														
Douglas-fir	857	82	16	2	23	67	10	87	13	(3/)	82	16	2	17
Hemlock-Sitka spruce	25	100	..	..	..	..	100	100	..	..	100	..	..	100
Ponderosa pine	7,029	86	13	1	67	32	1	88	11	1	86	13	1	1
Western white pine	110	..	90	10	..	90	10	..	90	10	..	90	10	..
Lodgepole pine	763	100	..	..	69	26	5	100	..	..	100	..	..	..
Larch	534	60	39	1	58	41	1	63	36	1	60	39	1	..
Fir-spruce	580	90	10	(3/)	48	43	9	100	(3/)	..	90	10	(3/)	..

See footnotes at end of table.

Table 74.--Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by region, forest type group, and ownership class, and by elements of the combined productivity class, 1953[1] - Continued

PACIFIC NORTHWEST

Forest type group and ownership class	Operating area	Productivity: By combined productivity class			Productivity: By existing stocking, all species			Productivity: By existing stocking plus prospective stocking all species			Productivity: Existing and prospective stocking modified by composition			Proportion of total on which felling age factors were applied
		High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	
	Thousand acres	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Small private ownerships (10 to 5,000 acres):														
Douglas-fir	3,091	58	29	13	28	44	28	67	26	7	65	27	8	57
Hemlock-Sitka spruce	280	64	33	3	41	37	22	73	24	3	68	29	3	46
Ponderosa pine	1,246	33	56	11	24	61	15	51	46	3	45	49	6	54
Western white pine	5	100	..	..	20	80	..	100	..	..	100	..	..	..
Lodgepole pine	31	94	6	..	94	..	6	94	6	..	94	6	..	..
Fir-spruce	50	60	8	32	20	78	2	86	14	..	60	8	32	..
Hardwoods	13	15	85	..	54	31	15	54	46	..	15	85	..	..
Medium and large private ownerships (5,000 acres and larger):														
Douglas-fir	4,501	85	11	4	49	42	9	86	10	4	86	10	4	12
Hemlock-Sitka spruce	1,750	95	1	4	91	5	4	95	5	..	95	5	..	30
Ponderosa pine	1,346	89	11	..	66	30	4	92	8	..	89	11	..	1
Western white pine	11	..	100	..	..	91	9	..	100	..	..	100	..	9
Larch	60	33	67	..	87	..	13	87	13	..	33	67	..	..
Fir-spruce	213	100	..	..	94	3	3	100	..	..	100	..	..	..
Public ownerships:														
Douglas-fir	7,828	84	13	3	49	48	3	86	13	1	85	14	1	17
Hemlock-Sitka spruce	1,209	94	6	(3/)	68	15	17	94	6	..	94	6	..	38
Ponderosa pine	7,165	87	12	1	67	32	1	88	11	1	87	12	1	1
Western white pine	113	3	87	10	3	87	10	3	87	10	3	87	10	..
Lodgepole pine	774	100	..	..	69	26	5	100	..	..	100	..	..	..
Larch	534	60	39	1	58	41	1	63	36	1	60	39	1	..
Fir-spruce	941	94	6	(3/)	54	39	7	100	(3/)	..	94	6	(3/)	..
Hardwoods	1	..	100	..	..	100	..	..	100	..	100	100	..	..

CALIFORNIA

Forest type group and ownership class	Operating area	Productivity: By combined productivity class			Productivity: By existing stocking, all species			Productivity: By existing stocking plus prospective stocking all species			Productivity: Existing and prospective stocking modified by composition			Proportion of total on which felling age factors were applied
		High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	
Small private ownerships (10 to 5,000 acres):														
Douglas-fir	261	75	24	1	6	43	51	76	23	1	75	24	1	..
Redwood	161	75	25	..	32	54	14	75	25	..	75	25	..	..
Ponderosa pine	350	41	36	23	28	50	22	45	36	19	41	36	23	5
Fir-spruce	20	..	100	..	..	60	40	..	100	..	..	100	..	..
Medium and large private ownerships (5,000 acres and larger):[4]														
Douglas-fir	521	81	19	..	32	23	45	81	19	..	81	19	..	..
Redwood	716	90	10	..	57	26	17	90	10	..	90	10	..	..
Ponderosa pine	1,266	85	15	..	36	64	..	85	15	..	85	15	..	5
Western white pine	85	90	10	..	70	30	..	97	3	..	90	10	..	..
Fir-spruce	342	100	..	..	71	29	..	100	..	..	100	..	..	..
Public ownerships:														
Douglas-fir	1,143	78	22	..	11	73	16	78	22	..	78	22	..	..
Redwood	66	100	..	..	21	..	79	100	..	..	100	..	..	..
Ponderosa pine	3,214	71	29	..	48	44	8	75	25	..	71	29	..	..
Western white pine	150	72	28	..	65	35	..	86	14	..	72	28	..	..
Fir-spruce	770	80	20	..	50	47	3	80	20	..	80	20	..	..

See footnotes at end of table.

Table 74.--Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by region, forest type group, and ownership class, and by elements of the combined productivity class, 1953[1] - Continued

NORTHERN ROCKY MOUNTAIN

Forest type group and ownership class	Operating area	Productivity: By combined productivity class			By existing stocking, all species			By existing stocking plus prospective stocking all species			Existing and prospective stocking modified by composition			Proportion of total on which felling age factors were applied
		High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	
	Thousand acres	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Small private ownerships (10 to 5,000 acres):														
Douglas-fir	308	25	60	15	19	52	29	27	70	3	27	70	3	50
Ponderosa pine	572	14	58	28	3	85	12	42	57	1	22	66	12	28
Western white pine	166	25	58	17	25	58	17	25	58	17	25	58	17	48
Lodgepole pine	61	..	51	49	5	95	..	5	95	..	..	51	49	92
Larch	209	76	24	..	65	32	3	79	21	..	76	24	..	52
Fir-spruce	12	..	100	..	..	100	..	..	100	..	..	100	..	..
Medium and large private ownerships (5,000 acres and larger):														
Douglas-fir	350	60	32	8	32	61	7	77	23	..	60	32	8	5
Ponderosa pine	890	41	50	9	23	65	12	51	49	..	41	50	9	2
Western white pine	373	19	65	16	6	69	25	19	65	16	19	65	16	50
Lodgepole pine	334	96	4	..	45	54	1	96	4	..	96	4	..	..
Larch	617	34	59	7	84	16	..	93	7	..	34	59	7	1
Fir-spruce	80	15	25	60	6	19	75	15	25	60	15	25	60	..
Public ownerships:														
Douglas-fir	4,894	70	26	4	28	68	4	70	27	3	70	26	4	8
Ponderosa pine	4,222	83	15	2	24	74	2	86	14	(3/)	83	15	2	6
Western white pine	1,579	12	44	44	..	44	56	12	45	43	12	44	44	..
Lodgepole pine	5,838	86	9	5	32	57	11	90	6	4	86	9	5	1
Larch	2,175	38	41	21	(3/)	99	1	44	56	..	38	41	21	..
Fir-spruce	2,148	34	45	21	7	54	39	34	45	21	34	45	21	..

SOUTHERN ROCKY MOUNTAIN

Forest type group and ownership class	Operating area	Combined High	Combined Medium	Combined Low	Existing High	Existing Medium	Existing Low	Existing plus prospective High	Existing plus prospective Medium	Existing plus prospective Low	Modified by composition High	Modified by composition Medium	Modified by composition Low	Proportion with felling age factors
Small private ownerships (10 to 5,000 acres):														
Douglas-fir	34	9	91	..	6	94	..	79	21	..	79	21	..	91
Ponderosa pine	241	29	52	19	20	33	47	30	55	15	29	52	19	4
Lodgepole pine	233	78	22	..	..	29	71	98	2	..	98	2	..	20
Fir-spruce	23	17	83	..	4	96	..	17	83	..	17	83	..	..
Hardwoods	9	100	..	..	..	100	..	100	..	..	100	..	..	..
Medium and large private ownerships (5,000 acres and larger):														
Douglas-fir	23	100	..	..	17	83	..	100	..	..	100	..	..	..
Ponderosa pine	808	57	27	16	9	70	21	57	27	16	57	27	16	16
Lodgepole pine	24	100	..	..	..	33	67	100	..	..	100	..	..	..
Fir-spruce	213	82	18	..	56	26	18	82	18	..	82	18	..	..
Public ownerships:														
Douglas-fir	158	100	..	..	59	41	..	100	..	..	100	..	..	..
Ponderosa pine	7,136	71	25	4	31	56	13	73	24	3	71	25	4	..
Lodgepole pine	1,666	96	4	(3/)	31	40	29	98	2	..	96	4	(3/)	..
Fir-spruce	2,746	91	8	1	36	64	..	94	6	..	91	8	1	..
Hardwoods	376	77	23	..	37	63	..	77	23	..	77	23	..	..

COASTAL ALASKA

Forest type group and ownership class	Operating area	Combined High	Combined Medium	Combined Low	Existing High	Existing Medium	Existing Low	Existing plus prospective High	Existing plus prospective Medium	Existing plus prospective Low	Modified by composition High	Modified by composition Medium	Modified by composition Low	Proportion with felling age factors
Public ownerships:														
Hemlock-Sitka spruce	4,224	89	11	..	87	13	..	89	11	..	89	11	..	..

See footnotes at end of table.

Table 74.--Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by region, forest type group, and ownership class, and by elements of the combined productivity class, 1953[1] - Continued

ALL REGIONS

Forest type group and ownership class	Operating area[4]	Productivity												Proportion of total on which felling age factors were applied
		By combined productivity class			By existing stocking, all species			By existing stocking plus prospective stocking, all species[2]			Existing and prospective stocking modified by composition			
		High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	
	Thousand acres	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Small private ownerships (under 5,000 acres):[5]														
Eastern type groups:														
White-red-jack pine	2,174	35	38	27	45	33	22	54	31	15	47	34	19	69
Spruce-fir	2,281	42	41	17	45	32	23	69	25	6	63	29	8	78
Longleaf-slash pine	7,635	29	33	38	10	42	48	39	29	32	38	29	33	48
Loblolly-shortleaf pine	21,654	36	31	33	43	29	28	49	31	20	47	31	22	61
Oak-pine	4,133	43	30	27	33	34	33	53	29	18	51	30	19	50
Oak-hickory	17,305	40	44	16	44	35	21	66	28	6	52	37	11	49
Oak-gum-cypress	4,045	26	53	21	20	32	48	49	38	13	36	46	18	70
Elm-ash-cottonwood	560	37	51	12	28	64	8	76	20	4	41	55	4	42
Maple-beech-birch	5,366	67	25	8	72	21	7	86	11	3	78	17	5	57
Aspen-birch	1,645	74	15	11	52	30	18	74	18	8	74	15	11	9
Western type groups:														
Douglas-fir	3,694	56	32	12	26	45	29	64	29	7	62	31	7	52
Hemlock-Sitka spruce	280	64	34	2	41	37	22	74	24	2	69	29	2	46
Redwood	161	75	25	..	32	54	14	75	25	..	75	25	..	..
Ponderosa pine	2,409	29	53	18	19	62	19	46	48	6	37	52	11	35
Western white pine	171	27	57	16	25	59	16	27	57	16	27	57	16	47
Lodgepole pine	325	65	26	9	10	38	52	80	20	..	79	12	9	32
Larch	209	76	24	..	65	33	2	79	21	..	76	24	..	52
Fir-spruce	105	32	52	16	10	81	9	45	55	..	32	52	16	..
Hardwoods	22	50	50	..	32	59	9	73	27	..	50	50	..	..
Medium and large private ownerships (5,000 acres and larger):[4]														
Eastern type groups:														
White-red-jack pine	568	79	17	4	58	28	14	89	9	2	80	16	4	42
Spruce-fir	8,160	73	26	1	81	17	2	88	12	(3/)	88	12	(3/)	75
Longleaf-slash pine	12,070	75	13	12	29	47	24	76	14	10	75	15	10	14
Loblolly-shortleaf pine	11,094	81	14	5	58	36	6	85	12	3	84	11	5	21
Oak-pine	1,416	68	21	11	61	28	11	76	16	8	75	16	9	28
Oak-hickory	4,950	59	33	8	35	52	13	77	19	4	65	29	6	54
Oak-gum-cypress	5,604	55	36	9	36	34	30	63	31	6	56	33	11	27
Elm-ash-cottonwood	17	100	..	..	94	6	..	100	..	..	100	..	..	..
Maple-beech-birch	5,828	71	26	3	67	29	4	91	9	(3/)	79	19	2	56
Aspen-birch	716	95	2	3	73	22	5	95	2	3	95	2	3	3
Western type groups:														
Douglas-fir	5,395	83	13	4	46	42	12	85	12	3	84	12	4	11
Hemlock-Sitka spruce	1,750	95	1	4	91	5	4	95	5	..	95	5	..	30
Redwood	716	90	10	..	58	26	16	90	10	..	90	10	..	..
Ponderosa pine	4,310	72	23	5	38	55	7	75	22	3	72	23	5	3
Western white pine	469	31	56	13	17	63	20	32	55	13	31	56	13	40
Lodgepole pine	358	96	4	..	42	53	5	96	4	..	96	4	..	..
Larch	677	34	60	6	84	15	1	93	7	..	34	60	6	1
Fir-spruce	848	88	7	5	67	21	12	88	7	5	88	7	5	..
Hardwoods	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Public ownerships:														
Eastern type groups:														
White-red-jack pine	2,705	68	30	2	29	55	16	80	19	1	68	31	1	15
Spruce-fir	4,319	77	23	(3/)	49	42	9	89	11	(3/)	80	20	(3/)	27
Longleaf-slash pine	2,713	93	5	2	23	72	5	95	3	2	93	5	2	5
Loblolly-shortleaf pine	3,734	90	9	1	68	24	8	95	4	1	95	4	1	10
Oak-pine	1,610	91	7	2	71	24	5	97	1	2	91	7	2	1
Oak-hickory	7,535	85	15	1	56	39	5	89	11	..	86	14	(3/)	14
Oak-gum-cypress	472	60	24	16	19	53	28	68	17	15	64	20	16	10
Elm-ash-cottonwood	228	42	47	11	6	71	23	66	23	11	42	47	11	..
Maple-beech-birch	4,725	94	5	1	91	8	1	96	4	..	94	5	1	31
Aspen-birch	6,646	85	15	(3/)	55	44	1	90	10	..	85	15	(3/)	13
Western type groups:														
Douglas-fir	14,023	79	18	3	38	57	5	80	18	2	79	18	3	12
Hemlock-Sitka spruce	5,433	90	10	(3/)	83	14	3	90	10	..	90	10	..	8
Redwood	66	100	..	..	21	..	79	100	..	..	100	..	..	..
Ponderosa pine	21,737	79	19	2	44	50	6	81	18	1	79	19	2	2
Western white pine	1,842	16	46	38	5	46	49	17	46	37	16	46	38	..
Lodgepole pine	8,278	90	7	3	35	51	14	92	5	3	90	7	3	1
Larch	2,709	42	40	18	12	87	1	48	52	(3/)	42	40	18	..
Fir-spruce	6,605	72	21	7	31	55	14	74	19	7	72	21	7	..
Hardwoods	377	77	23	..	37	63	..	77	23	..	77	23	..	..

1/ Prepared by Forest Service, U. S. Department of Agriculture. The determination of size class of private ownership was based on the total commercial forest land area in the ownership. The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Productivity is expressed as a percentage of the operating area found to be in a high, medium, or low productivity class according to measurement of the four elements taken into account in arriving at a combined productivity index.

2/ For eastern type groups prospective stocking estimated for desirable species only.

3/ Less than 0.5 percent.

4/ Excludes operating area on some large private ownerships on which access was denied.

5/ Includes ownerships containing 3 to 5,000 acres of commercial forest land in the East and 10 to 5,000 acres in the West.

Table 75.--Estimated domestic consumption, domestic output of timber products, and domestic timber cut in the United States and Coastal Alaska by softwoods and hardwoods, 1952, and projected lower level domestic requirements, output, and timber cut, 1975 and 2000[1]

Product and species group	Standard unit of measure[2]	1952: Domestic consumption	1952: Timber products output: Total	1952: Timber products output: From roundwood	1952: Timber cut: Growing stock	1952: Timber cut: Live sawtimber		1975--lower level: Domestic requirements[3]	1975: Timber products output: Total	1975: Timber products output: From roundwood	1975: Timber cut: Growing stock	1975: Timber cut: Live sawtimber		2000--lower level: Domestic requirements[4]	2000: Timber products output: Total	2000: Timber products output: From roundwood	2000: Timber cut: Growing stock	2000: Timber cut: Live sawtimber	
		Million units	Million units	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million units	Million units	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million units	Million units	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.
Sawlogs (for lumber, timbers, sawn ties, etc.):																			
Softwood	Bd. ft. lbr. tally	33,408	31,507	4,921	5,214	5,055	28,890	36,000	35,030	5,471	5,688	5,548	31,791	41,000	40,030	6,251	6,565	6,405	36,220
Hardwood	do.	8,054	8,003	1,225	1,607	1,510	7,746	10,000	9,970	1,526	1,962	1,793	9,400	14,000	13,970	2,138	2,744	2,506	13,036
Total	do.	[5] 41,462	39,510	6,146	6,821	6,565	36,636	[6] 46,000	45,000	6,997	7,650	7,341	41,191	[6] 55,000	54,000	8,389	9,309	8,911	49,256
Veneer logs and bolts:																			
Softwood	Bd. ft. log scale	1,548	1,548	249	251	250	1,575	2,700	2,700	434	416	416	2,615	4,000	4,000	643	624	624	3,866
Hardwood	do.	919	919	173	241	238	1,228	1,800	1,800	339	484	479	2,482	2,500	2,000	376	540	534	2,744
Total	do.	2,467	2,467	422	492	488	2,803	4,500	4,500	773	900	895	5,097	[7] 6,500	6,000	1,019	1,164	1,158	6,610
Pulpwood:																			
Softwood	Standard cords	31.3	21.4	1,550	1,460	871	4,252	45.3	32.0	2,317	1,869	1,077	5,006	66.0	52.7	3,798	2,635	1,570	8,063
Hardwood	do.	4.1	3.7	273	267	104	441	10.7	10.0	741	633	201	871	24.0	23.3	1,716	1,328	443	1,747
Total	do.	[8] 35.4	25.1	1,823	1,727	975	4,693	[9] 56.0	42.0	3,058	2,502	1,278	5,877	[9] 90.0	76.0	5,514	3,963	2,013	9,810
Cooperage logs and bolts:																			
Softwood	Bd. ft. log scale	117.9	117.9	26	29	27	143	112	112	25	28	26	136						
Hardwood	do.	237.4	237.4	47	76	75	373	288	288	57	94	92	458						
Total	do.	355.3	355.3	73	105	102	516	400	400	82	122	118	594						
Piling:																			
Softwood	Linear feet	37.9	37.9	26	30	29	148	36	36	25	28	27	140						
Hardwood	do.	3.3	3.3	2	2	2	11	4	4	2	3	3	14						
Total	do.	41.2	41.2	28	32	31	159	40	40	27	31	30	154						
Poles:																			
Softwood	Pieces	6.4	6.4	87	100	91	466	5	5	68	74	68	357	Million cu. ft.	Million cu. ft.	(Not allocated to products)			
Hardwood	do.	.1	.1	1	1	1	4	..	..	..	..	..	..						
Total	do.	6.5	6.5	88	101	92	470	5	5	68	74	68	357						
Posts (round and split):																			
Softwood	Pieces	103.3	103.3	69	49	15	69	90	90	60	42	12	59	404	404	353	348	249	1,088
Hardwood	do.	202.7	202.7	125	82	29	149	190	190	118	71	16	80	461	461	431	425	250	1,167
Total	do.	306.0	306.0	194	131	44	218	280	280	178	113	28	139	865	865	784	773	499	2,255
Hewn ties:																			
Softwood	Pieces	3.7	3.7	23	32	32	152	1.2	1.2	7	11	10	50						
Hardwood	do.	6.5	6.5	44	77	74	331	1.8	1.8	12	22	22	98						
Total	do.	10.2	10.2	67	109	106	483	3.0	3.0	19	33	32	148						
Mine timbers (round):																			
Softwood	Cubic feet	18.5	18.5	19	19	9	41	30	30	30	29	14	65						
Hardwood	do.	62.5	62.5	62	58	14	59	100	100	100	91	23	94						
Total	do.	81.0	81.0	81	77	23	100	130	130	130	120	37	159						
Other industrial wood:[10]																			
Softwood	Cubic feet	112.3	112.3	76	60	38	215	140	140	95	74	52	298						
Hardwood	do.	114.7	114.7	92	98	66	301	140	140	112	112	73	341						
Total	do.	227.0	227.0	168	158	104	516	280	280	207	186	125	639	Million units	Million units				
Total all industrial wood:																			
Softwood	. . . .			7,046	7,244	6,417	35,951	. . . . . .		8,532	8,259	7,250	40,517	. . . . . .		11,045	10,172	8,848	49,237
Hardwood	. . . .			2,044	2,509	2,113	10,643	. . . . . .		3,007	3,472	2,702	13,838	. . . . . .		4,661	5,037	3,733	18,694
Total	. . . .			9,090	9,753	8,530	46,594	. . . . . .		11,539	11,731	9,952	54,355	. . . . . .		15,706	15,209	12,581	67,931
Fuelwood:[11]																			
Softwood	Standard cords	31.1	31.1	476	243	144	595	18	18	278	144	72	343	17	17	262	136	68	323
Hardwood	do.	27.5	27.5	1,532	761	394	1,651	22	22	1,226	552	309	1,292	13	13	724	312	182	754
Total	do.	58.6	58.6	2,000	1,004	538	2,246	40	40	1,504	696	381	1,635	30	30	986	448	250	1,077
Total all timber products:																			
Softwood	. . . .			7,522	7,487	6,561	36,546	. . . . . .		8,810	8,403	7,322	40,860	. . . . . .		11,307	10,308	8,916	49,560
Hardwood	. . . .			3,576	3,270	2,507	12,294	. . . . . .		4,233	4,024	3,011	15,130	. . . . . .		5,385	5,349	3,915	19,448
Total	. . . .			11,098	10,757	9,068	48,840	. . . . . .		13,043	12,427	10,333	55,990	. . . . . .		16,692	15,657	12,831	69,008

1/ Prepared by Forest Service, U. S. Department of Agriculture. Projected lower level requirements were developed chiefly from analysis of consumption trends, product by product, with evaluation of various evident factors that may influence future use of timber products.

2/ Units are those commonly used by the Bureau of the Census, the trade, or other agencies reporting volume of output or consumption. Roundwood volumes expressed in cubic feet exclude bark while roundwood volumes in standard cords (128 cubic feet) include bark. Domestic consumption or requirements and timber products output are expressed in units commonly used for various products. Timber products output from roundwood, i.e., exclusive of volumes of different products, chiefly pulpwood and fuelwood, derived from slabs, edgings, veneer cores, and other plant residues, is expressed in cubic feet. Such plant residue material is accounted for in roundwood products other than pulpwood and fuelwood. Timber cut is expressed in both cubic feet roundwood and in board feet log-scale, International 1/4-inch rule.

3/ Assuming a population of 210 million in 1975, gross national product (in constant dollars) increasing by 100 percent between 1950 and 1975.

4/ Assuming a population of 210 million in 1975 and 275 million in 2000, gross national product (in constant dollars) increasing by 100 percent between 1950 and 1975 with further increase (on such 1975 base) of 90 percent between 1975 and 2000.

5/ Includes 1,752 million board feet net imports of lumber.

6/ Includes 1 billion board feet of net imports.

7/ Includes 500 million board feet net imports of veneer logs and bolts or veneer-log equivalent of veneer and veneer products.

8/ Includes 11.2 million cords net imports of pulpwood and pulpwood-equivalent of woodpulp and paper.

9/ Includes 14 million cords net imports of pulpwood and pulpwood-equivalent of woodpulp and paper.

10/ Includes such products as box bolts, shingle logs and bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, split stakes and shakes, and miscellaneous farm timber.

11/ For both domestic and industrial use.

Table 76.--Estimated domestic consumption, domestic output of timber products, and domestic timber cut in the United States and Coastal Alaska, by product groups and softwoods and hardwoods, 1952, and projected levels of domestic requirements, output, and timber cut, 1975 and 2000[1/]

Item	Standard unit of measure[2/]	1952			1975						2000					
					Lower level			Upper level			Lower level			Upper level		
		Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
		Million units	Million units	Million units	Million units	Million units	Million units	Million units	Million units	Million units	Million units	Million units	Million units	Million units	Million units	Million units
All industrial wood:																
Domestic consumption or requirements	Cubic feet roundwood	3/ 10,237	8,146	2,091	4/ 12,787	9,720	3,067	4/ 14,289	10,838	3,451	5/ 17,049	12,233	4,816	5/ 21,009	14,954	6,055
Timber products output from roundwood	Cubic feet roundwood	9,090	7,046	2,044	11,539	8,532	3,007	13,041	9,650	3,391	15,706	11,045	4,661	19,666	13,766	5,900
Timber cut: Growing stock	Cubic feet roundwood	9,753	7,244	2,509	11,731	8,259	3,472	13,298	9,413	3,885	15,209	10,172	5,037	19,265	12,849	6,416
Live sawtimber	Cubic feet roundwood	8,530	6,417	2,113	9,952	7,250	2,702	11,262	8,252	3,010	12,581	8,848	3,733	15,907	11,164	4,743
	Board feet	46,594	35,951	10,643	54,355	40,517	13,838	63,795	47,277	16,518	67,931	49,237	18,694	94,003	68,087	25,916
Fuelwood:[6/]																
Domestic consumption or requirements	Standard cords	58.6	31.1	27.5	40.0	18.0	22.0	40.0	18.0	22.0	30.0	17.0	13.0	30.0	17.0	13.0
Timber products output from roundwood	Standard cords	27.2	6.2	21.0	20.4	3.6	16.8	20.4	3.6	16.8	13.3	3.4	9.9	13.3	3.4	9.9
Timber cut: Growing stock	Cubic feet roundwood	1,004	243	761	696	144	552	696	144	552	448	136	312	448	136	312
Live sawtimber	Cubic feet roundwood	538	144	394	381	72	309	381	72	309	250	68	182	250	68	182
	Board feet	2,246	595	1,651	1,635	343	1,292	1,635	343	1,292	1,077	323	754	1,077	323	754
All timber products:																
Domestic consumption or requirements	Cubic feet roundwood	3/ 12,245	8,622	3,623	4/ 14,291	9,998	4,293	4/ 15,793	11,116	4,677	5/ 18,035	12,495	5,540	5/ 21,995	15,216	6,779
Timber products output from roundwood	Cubic feet roundwood	11,098	7,522	3,576	13,043	8,810	4,233	14,545	9,928	4,617	16,692	11,307	5,385	20,652	14,028	6,624
Timber cut: Growing stock	Cubic feet roundwood	10,757	7,487	3,270	12,427	8,403	4,024	13,994	9,557	4,437	15,657	10,308	5,349	19,713	12,985	6,728
Live sawtimber	Cubic feet roundwood	9,068	6,561	2,507	10,333	7,322	3,011	11,643	8,324	3,319	12,831	8,916	3,915	16,157	11,232	4,925
	Board feet	48,840	36,546	12,294	55,990	40,860	15,130	65,430	47,620	17,810	69,008	49,560	19,448	95,080	68,410	26,670

1/ Prepared by Forest Service, U. S. Department of Agriculture. Assumptions for 1975 requirements projections: A population of 210 million in 1975 gross national product (in constant dollars) increasing by 100 percent between 1950 and 1975. Assumptions for 2000 requirements projections: A population of 275 million in 2000, gross national product (in constant dollars) increasing by 100 percent between 1950 and 1975 with further increase (on such 1975 base) of 90 percent between 1975 and 2000. Projected lower-level requirements developed chiefly from analysis of consumption trends, product by product, with evaluation of various evident factors that may influence future use of timber products. Projected upper-level requirements assume (a) that the consumption of all physical-structure raw materials (all raw materials except food, energy materials, and gold) continues to increase at about the rate that prevailed over the period 1900 to 1950; (b) that industrial wood might constitute the same percentage of such 1975 and 2000 mix of physical-structure raw materials consumption that it constituted in 1952. Projection for fuelwood, and net imports same as for lower-level projections.

2/ Cubic feet excluding bark; standard cords (128 cubic feet) including bark; board-feet log-scale, International 1/4-inch rule. Domestic consumption or requirements include the cubic-foot roundwood equivalent of net imports of lumber, pulpwood, woodpulp and paper, veneer logs and bolts, and veneer and veneer products. Timber products output from roundwood is expressed in cubic feet for all industrial wood and for all products combined, and in standard cords for fuelwood which is exclusive of the volume derived from slabs, edgings, veneer cores, and other plant residues; such plant residue material is accounted for in roundwood products other than fuelwood.

3/ Includes 1,147 million cubic feet representing 1,752 million board feet net imports of lumber and 11.2 million cords net imports of pulpwood and pulpwood-equivalent of woodpulp and paper.

4/ Includes 1,248 million cubic feet representing 1 billion board feet net imports of lumber and 14 million cords net imports of pulpwood and pulpwood-equivalent of woodpulp and paper.

5/ Includes 1,343 million cubic feet representing 1 billion board feet net imports of lumber, 14 million cords net imports of pulpwood and pulpwood-equivalent of woodpulp and paper, and 500 million board feet net imports of veneer logs and bolts or veneer-log equivalent of veneer and veneer products.

6/ For both domestic and industrial use.

Table 77.--Proportion of area in ownerships in the United States and Coastal Alaska on which some stand improvement is being done on commercial forest land other than recently cut areas, by ownership class and size class of private ownership, and by section and region, 1953[1]

Section and region	All public ownerships		National forest		Bureau of Land Management		Indian		Other Federal		State, county, and municipal	
	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done
	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent
North:												
New England	1,741	73	822	86	..	..	..	..	82	..	837	67
Middle Atlantic	5,514	58	1,339	79	..	..	..	..	202	7	3,973	53
Lake States	21,439	48	5,895	77	67	..	1,119	26	459	..	13,899	38
Central	3,190	65	2,181	75	1	..	1	..	449	2	558	73
Plains	542	..	45	..	4	..	368	..	60	..	65	..
Total or average	32,426	51	10,282	77	72	..	1,488	20	1,252	2	19,332	44
South:												
South Atlantic	4,016	35	2,783	33	..	..	47	..	654	44	532	39
Southeast	7,789	34	3,892	42	28	..	46	..	2,271	31	1,552	19
West Gulf	4,874	39	3,697	46	126	..	24	83	628	20	399	4
Total or average	16,679	36	10,372	41	154	..	117	17	3,553	32	2,483	21
West:												
Pacific Northwest:												
Douglas-fir subregion	12,130	32	7,139	42	2,256	20	257	68	55	..	2,423	13
Pine subregion	13,661	63	9,970	78	404	..	2,506	37	63	..	718	..
Total or average	25,791	49	17,109	63	2,660	17	2,763	39	118	..	3,141	10
California	9,264	73	8,573	78	324	..	133	..	40	..	194	27
Northern Rocky Mountain	25,381	56	21,627	66	1,206	..	822	..	83	..	1,643	4
Southern Rocky Mountain	16,549	41	13,351	45	1,097	58	1,622	12	56	..	423	..
Total or average	76,985	53	60,660	62	5,287	20	5,340	24	297	..	5,401	8
Continental United States	126,090	50	81,314	61	5,513	20	6,945	23	5,102	22	27,216	34
Coastal Alaska	4,250	..	3,445	..	785	..	20	..	..	..	..	..
All regions	130,340	48	84,759	59	6,298	17	6,965	23	5,102	22	27,216	34

Section and region	All private		Small private holdings: Under 100 acres[3]		Small private holdings: 100 to 500 acres		Small private holdings: 500 to 5,000 acres		Medium private holdings: 5,000 to 50,000 acres		Large private holdings: 50,000 acres and larger	
	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done
	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent
North:												
New England	28,917	8	7,900	5	7,495	8	1,581	11	2,253	21	9,688	8
Middle Atlantic	36,711	8	18,605	3	9,367	6	3,202	20	3,347	9	2,190	43
Lake States	31,833	5	15,773	1	8,930	2	1,677	8	1,639	10	3,814	20
Central	39,204	1	22,926	(4/)	11,393	[illegible]	3,481	(4/)	1,004	7	400	39
Plains	4,950	..	4,134	..	423	..	273	..	120	..	..	..
Total or average	141,615	5	69,338	2	37,608	4	10,214	9	8,279	12	16,176	16
South:												
South Atlantic	42,136	11	15,150	2	14,882	2	5,495	7	2,983	21	3,626	82
Southeast	87,196	15	21,094	1	24,745	3	16,142	8	11,901	20	13,314	65
West Gulf	47,277	24	12,071	1	12,822	5	5,791	9	5,291	21	11,302	81
Total or average	176,609	16	48,315	2	52,449	3	27,428	8	20,140	20	28,277	74
West:												
Pacific Northwest:												
Douglas-fir subregion	13,325	17	1,859	1	2,534	2	1,724	2	2,199	1	5,009	42
Pine subregion	6,249	1	333	..	1,682	..	1,822	..	791	11	1,621	..
Total or average	19,574	12	2,192	1	4,216	1	3,546	1	2,865	4	6,755	32
California	8,053	4	301	..	1,022	(4/)	1,293	..	2,297	2	3,140	9
Northern Rocky Mountain	8,459	5	641	5	1,826	..	2,610	..	609	6	2,773	12
Southern Rocky Mountain	3,940	2	226	..	752	..	1,287	..	672	..	1,003	7
Total or average	40,026	8	3,360	1	7,816	1	8,736	(4/)	6,400	3	13,714	21
Continental United States	358,250	11	121,013	2	97,873	3	46,378	7	34,669	15	58,317	45
Coastal Alaska	19	..	10	..	9	..	..	..	..	..	..	..
All regions	358,269	11	121,023	2	97,882	3	46,378	7	34,669	15	58,317	45

Section and region	Farm		Lumber manufacturer		Pulp manufacturer		Other wood manufacturer		Other private		All ownerships	
	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done	Total area owned	Proportion of area[2] in ownerships on which some stand improvement is being done
	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent
North:												
New England	6,138	14	1,002	19	6,840	8	336	15	14,601	6	30,658	12
Middle Atlantic	11,800	9	977	20	889	70	203	2	22,842	5	42,225	15
Lake States	15,184	2	1,435	4	1,495	50	109	..	13,610	3	53,272	22
Central	24,697	1	541	..	..	..	276	31	13,690	1	42,394	6
Plains	3,575	..	..	..	..	..	..	..	1,375	..	5,492	..
Total or average	61,394	4	3,955	11	9,224	21	924	15	66,118	4	174,041	14
South:												
South Atlantic	29,968	4	2,620	15	2,603	97	391	11	6,554	5	46,152	13
Southeast	45,957	3	6,587	37	6,963	91	1,893	30	25,796	10	94,985	17
West Gulf	14,218	4	9,310	61	2,622	95	534	59	20,593	12	52,151	26
Total or average	90,143	3	18,517	46	12,188	93	2,818	33	52,943	10	193,288	18
West:												
Pacific Northwest:												
Douglas-fir subregion	3,001	2	5,036	35	1,577	16	341	..	3,370	4	25,455	24
Pine subregion	2,343	..	1,822	5	104	..	..	..	1,980	..	19,910	44
Total or average	5,344	1	6,858	27	1,681	15	341	..	5,350	3	45,365	33
California	1,586	3	3,076	9	173	..	140	..	3,078	..	17,317	41
Northern Rocky Mountain	4,001	1	2,131	17	10	..	190	..	2,127	1	33,840	44
Southern Rocky Mountain	2,749	2	150	..	..	..	6	..	1,035	2	20,489	33
Total or average	13,680	1	12,215	20	1,864	14	677	..	11,590	2	117,011	37
Continental United States	165,217	3	34,687	33	23,276	58	4,419	24	130,651	6	484,340	21
Coastal Alaska	..	..	..	..	..	..	..	..	19	..	4,269	..
All regions	165,217	3	34,687	33	23,276	58	4,419	24	130,670	6	488,609	21

1/ Prepared by Forest Service, U. S. Department of Agriculture. Because some owners have various size holdings in one or more regions the determination of size class of private ownership and area owned is based on the total commercial forest land area in the ownership, whether for a region, section, or for the country as a whole. Thus, except for small ownerships, regional totals do not add to sectional totals that give the proper ownership size-class distribution on a sectional basis, nor do sectional totals add to national totals which show the correct ownership size-class distribution for the entire country. Data were lacking on which to adjust for possible duplication of ownership in small ownership classes when considered strictly on a sectional or regional basis. Such duplication that may exist in small ownerships is, however, believed to affect relatively less area than in the medium and large classes.

2/ The area in each ownership sampled, except for areas cutover since 1947, was examined for stand improvement done during the period 1947-52. If stand improvement was applied on any portion of an individual ownership the entire area of the ownership was classed as one on which some stand-improvement work had been done. The combined area of such ownerships rather than the actual acreage treated was used in computing the percentage of commercial forest land within each size class and type of ownership.

3/ Includes ownerships containing 3 to 100 acres of commercial forest land in the East and 10 to 100 acres in the West.

4/ Less than 0.5 percent.

Table 78.--Estimate of employment and income connected with the timber resource in the United States, 1952

Economic activity 1/	Persons productively engaged 2/ Total	Estimated employment in timber-connected activity		Compensation of employees 3/ Total	Estimate of timber-connected compensation	National income 4/ Total	Estimate of timber-connected national income
	Thousand man-years	Percent	Thousand man-years	Million dollars	Million dollars	Million dollars	Million dollars
All economic activity	63,485*	5.4	3,398	195,423*	10,835	290,959*	14,528
Timber-based industries:							
Forestry services (growing and protection of timber) 5/	65**	100.0	65	147**	147	164**	164
Lumber and timber basic products	655**	100.0	655	1,944**	1,944	2,479**	2,479
Paper and allied products	504*	100.0	504	2,134*	2,134	3,144*	3,144
Furniture and fixtures	563**	55.0	310	1,854**	1,020	2,206**	1,213
Total	1,787	86.0	1,534	6,079	5,245	7,993	7,000
Timber-connected activity elsewhere in the economy:							
Farming (including contract construction on farms) 6/	5,731*	5.0	300	3,246*	7/ 600	17,955*	898
Contract construction and maintenance, nonfarm 8/	3,622*	20.0	700	10,946*	2,189	14,223*	2,845
Synthetic fiber manufacture, chiefly rayon 9/	72***	78.0	56	281***	219	10/ 367***	286
Textile mill products, including rayon textile	1,199*	15.0	180	3,756*	563	4,541*	681
Railroad transportation, freight 11/	1,244*	13.0	158	5,819*	756	7,182*	934
Highway and water freight transportation	879*	8.0	70	3,433*	275	4,454*	356
Wholesale and retail trade	11,816*	3.0	400	32,947*	988	50,938*	1,528
Total	24,563	7.6	1,864	60,428	5,590	99,660	7,528
All timber-connected activity specified above	26,350	12.9	3,398	66,507	10,835	107,653	14,528

1/ STANDARD INDUSTRIAL CLASSIFICATION, 1942 and 1945 editions.

2/ Full-time employment of persons working for wages and salaries and of active proprietors of unincorporated enterprises.

3/ Wages and salaries, plus supplements to wages and salaries such as employers' contributions to social security, private pensions and welfare funds, etc.

4/ Includes compensation of employees, proprietors' net income, corporate net income before corporate income taxes, net rent, and net interest.

5/ Department of Commerce estimates of private employment raised to include public employment, corresponding increase of compensation and national income.

6/ Department of Commerce estimate of persons productively engaged raised by 75,000 to include estimated employment in contract construction on farms.

7/ Based on $2,000 per man-year to include remuneration of self-employment by farmers.

8/ Department of Commerce estimate reduced by 75,000 man-years to exclude contract construction on farms. Corresponding adjustment of employee compensation and national income.

9/ Includes 7,000 man-years of employment in manufacture of gum products and other wood-chemical products. Bureau of the Census, ANNUAL SURVEY OF MANUFACTURES, 1952. Compensation-of-employees figure is Bureau of the Census estimate of wages and salaries.

10/ This estimate based on the ratio of employee-compensation to national-income of the chemicals and allied products industries group. Department of Commerce, NATIONAL INCOME, 1954 edition.

11/ Department of Commerce estimates lowered by 10 percent to exclude passenger service employment, compensation, and national income.

Sources of base estimates: (*) U.S. Department of Commerce, NATIONAL INCOME, 1954 edition; (**) U.S. Department of Commerce, SURVEY OF CURRENT BUSINESS, July, 1953; (***) Bureau of the Census, ANNUAL SURVEY OF MANUFACTURES, 1952.

Regions and Sections used in the Timber Resource Review

TIMBER RESOURCE REVIEW

CHAPTER IX
APPENDICES

B. <u>DEFINITION OF TERMS</u>

C. <u>CONVERTING FACTORS</u>

D. <u>SAMPLING STANDARDS</u>

(Preliminary Review Draft Subject To Revision)

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INDEX TO TIMBER RESOURCE REVIEW REPORTS AND APPENDIX MATERIAL

(Each Chapter and each Section, in the case of Chapters IV and IX, is a separate document)

TIMBER RESOURCE REVIEW

CHAPTER IX. A P P E N D I C E S

B. DEFINITION OF TERMS

(Preliminary review draft subject to revision)

September, 1955

DEFINITION OF TERMS [1]

Absolute consumption. See "consumption."

Acceptable plantation. See "plantation."

Allowable cut. The volume of live sawtimber and growing stock that can be cut during a given period while building up or maintaining sufficient growing stock to meet specified growth levels.

All-timber volume.. Net volume in cubic feet of live and salvable dead sawtimber trees and poletimber trees of commercial species, and cull trees of all species, from stump to a minimum 4.0-inch top inside bark. Includes bole only of softwoods but both bole and limbs of hardwoods to a minimum 4.0-inch diameter inside bark. Also given in standard cords.

Bureau of Land Management ownership. See "ownership."

Catastrophic timber mortality. The net volume removed from live sawtimber or growing stock on commercial forest land during a specified period through death from natural causes of extreme severity. The loss in volume is of sufficient quantity to cause a major dislocation of forest management and timber utilization plans for a State or subregion. Examples of catastrophes: An unusually severe insect attack, an extraordinary windstorm such as the New England hurricane or a holocaust such as the Tillamook burn. A catastrophe is characterized by its unpredictable nature, suddenness and concentration of occurrence, as well as the extreme quantity of destruction. Although the loss usually is suffered in a period less than a year, it may extend over more than a year as in insect attacks. Past losses are considered catastrophic if the individual occurrence resulted in an annual mortality greater than the net annual growth of the State or region in 1952.

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[1] These are terms used in Chapters I - VII, the sections dealing with Interior Alaska, Canada and Mexico of Chapter VIII, and in Chapter IX of the Timber Resource Review. Terms used in the section "The World Timber Situation" of Chapter VIII are defined therein if needed.

Chaparral land area. Lands supporting heavily branched dwarf trees or shrubs, usually evergreen, the crown canopy of which covers more than 50 percent of the ground and whose primary value is watershed protection. The more common chaparral constituents are species of *Quercus*, *Cercocarpus*, *Garrya*, *Ceanothus*, *Arctostaphylos*, and *Adenostoma*. Types dominated by such shrubs as *Artemisia*, *Opuntia*, *Purshia*, *Gutierrezia*, or semi-desert species are not commonly considered chaparral.

Commercial forest land area. See "forest land area."

Commercial species. Tree species considered in determining stocking and growing stock. Includes species presently or prospectively usable for commercial timber products; excludes so-called weed species such as sassafras, hawthorn, and ironwood.

Constant-dollar quantity unit. The quantity of a class of raw material which could have been purchased for one dollar at its average price during a specified period.

Consumption.

Absolute consumption. The total consumption of a specified material.

Relative consumption. The consumption of a specified material in relation to a group of similar materials. See Chapter V, "Some Factors Influencing Past Consumption of Timber Products," for further explanation.

County and municipal ownership. See "ownership."

Cropland. See "land area."

Cull trees. Live trees of sawtimber or poletimber size that are unmerchantable for sawlogs now or prospectively because of defect, rot or species.

Sound cull trees. Live trees of sawtimber or poletimber size which meet regional specifications of freedom from rot, but will not make at least one merchantable sawlog now or prospectively according to regional specifications because of roughness, poor form, or species.

Rotten cull trees. Live trees of sawtimber or poletimber size which fail to meet regional specifications of proportion of sound volume to total volume.

Diameter classes. A classification of trees based on diameter of the bole, outside bark, measured at breast height ($4\frac{1}{2}$ feet above the ground). D.b.h. is the common abbreviation for "diameter at breast height." Two-inch diameter classes, of which the even inch is the approximate midpoint, are used. For example, the 6-inch class includes trees 5.0 to 6.9 inches d.b.h., the 12-inch class includes trees 11.0 to 12.9 inches, d.b.h.

Farm ownership. See "ownership."

Federal ownership. See "ownership."

Fire protection status. A classification of commercial and noncommercial forest lands requiring protection from fire according to the degree of protection given them.

Protected.

Class 1. Protection adequate to meet the fire situation in worst years and under serious peak load conditions.

Class 2. Protection adequate to meet the average fire situation but failures likely in worst years and under peak load conditions.

Class 3. Protection adequate to meet the fire situation in easy years but failures frequent in average or worse years.

Unprotected. No protection given.

Forest industries. See "ownership."

Forest land area. Includes (a) lands which are at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting an influence on the climate or on the water regime; (b) land from which the trees described in (a) have been removed to less than 10 percent stocking and which have not been developed for other use; (c) afforested areas; and (d) chaparral areas. Does not include orchard land. The minimum area that qualifies as forest land is one acre in the East and 10 acres in the West. Roadside, streamside, and shelterbelt strips of timber, in addition to meeting above requirements, must be at least 120 feet wide to qualify as forest land.

Commercial forest land area. Forest land which (a) is producing, or physically capable of producing, usable crops of wood (usually sawtimber), (b) economically available now or prospectively, and (c) not withdrawn from timber utilization.

Noncommercial forest land area. Forest land (a) withdrawn from timber utilization through statute, ordinance, or administrative order but which otherwise qualifies as commercial forest land, or (b) incapable of yielding usable wood products (usually sawtimber) because of adverse site conditions, or so physically inaccessible as to be unavailable economically in the foreseeable future.

Reserved forest land area. Productive or unproductive public forest land set aside by statute, ordinance or administrative order for parks, monuments, wilderness areas, and other special uses.

Unproductive forest land area. Forest land incapable of yielding usable wood products (usually sawtimber) because of adverse site conditions, or so physically inaccessible as to be unavailable economically in the foreseeable future. Includes chaparral land in the West. (Unproductive forest land area includes lands that are productive in grazing, watershed, recreational and wildlife uses.)

Forest type groups. A classification of forest areas based upon the predominant species composition of the present tree cover. The major forest types used in this Review are comprised of groups of local forest cover types. The forest type names indicate the predominant species except in the redwood and western white pine types. Predominance is measured in terms of cubic volume in sawtimber and poletimber stands and number of trees in seedling and sapling stands. When none of the indicated species comprise 50 percent or more (20 percent or more in the redwood and western white pine types), the stand is typed on the basis of plurality of cubic volume or number of trees. The major forest type groups found on commercial forest land and reserved noncommercial forest land are listed below:

Major western forest type groups.

Douglas-fir. Forests in which 50 percent or more of the stand is Douglas-fir, except where redwood, sugar pine, or western white pine comprise 20 percent or more, in which case the stand would be classified as redwood type or white pine type.

Hemlock-sitka spruce. Forests in which 50 percent or more of the stand is western hemlock and/or sitka spruce.

Redwood. Forests in which 20 percent or more of the stand is redwood.

Ponderosa pine. Forests in which 50 percent or more of the stand is ponderosa pine, Jeffrey pine, sugar pine, limber pine, Arizona pine, Apache pine, or Chihuahua pine, singly or in combination except where western white pine or sugar pine comprise 20 percent or more, in which case the stand would be classified as white pine type.

Western white pine. Forests in which 20 percent or more of the stand is western white pine or sugar pine.

Lodgepole pine. Forests in which 50 percent or more of the stand is lodgepole pine.

Larch. Forests in which 50 percent or more of the stand is larch except where western white pine comprises 20 percent or more, in which case the stand would be classified as white pine.

Fir-spruce. Forests in which 50 percent or more of the stand is true fir (Abies spp.), Englemann spruce, Colorado blue spruce, or mountain hemlock, singly or in combination, except where western white pine comprises 20 percent or more, in which case the stand would be classified as white pine.

Pinyon pine-juniper. Forests in which 50 percent or more of the stand is pinyon pine, digger pine, coulter pine, juniper, or cypress, singly or in combination.

Major western forest type groups (continued)

Hardwoods. Forests in which 50 percent or more of the stand is hardwood species, except where western white pine, sugar pine or redwood comprises 20 percent or more, in which case the stand would be classified as white pine or redwood.

Major eastern forest type groups.

White-red-jack pine. Forests in which 50 percent or more of the stand is eastern white pine, red pine, or jack pine, singly or in combination. (Common associates include hemlock, aspen, birch, and maple.)

Spruce-fir. Forests in which 50 percent or more of the stand is spruce or true firs, singly or in combination. (Common associates include white cedar, tamarack, maple, birch and hemlock.)

Longleaf-slash pine. Forests in which 50 percent or more of the stand is longleaf or slash pine, singly or in combination. (Common associates include other southern pines, oak and gum.)

Oak-pine. Forests in which 50 percent or more of the stand is hardwoods, usually upland oaks, but in which southern pines make up 25-49 percent of the stand. (Common associates include gum, hickory, and yellow poplar.)

Oak-hickory. Forests in which 50 percent or more of the stand is upland oaks or hickory, singly or in combination, except where pines comprise 25-49 percent in which case the stand would be classified "oak-pine". (Common associates include yellow-poplar, elm, maple, and black walnut.)

Oak-gum-cypress. Bottomland forests in which 50 percent or more of the stand is tupelo, blackgum, sweetgum, oaks, or southern cypress, singly or in combination, except where pines comprise 25-49 percent in which case the stand would be classified "oak-pine." (Common associates include cottonwood, willow, sycamore, beech and maple.)

Elm-ash-cottonwood. Forests in which 50 percent or more of the stand is elm, ash or cottonwood, singly or in combination. (Common associates include willow, sycamore, beech and maple.)

Maple-beech-birch. Forests in which 50 percent or more of the stand is maple, beech, or yellow birch, singly or in combination. (Common associates include hemlock, elm, basswood and white pine.)

Aspen-birch. Forests in which 50 percent or more of the stand is aspen, balsam poplar, paper birch or gray birch, singly or in combination. (Common associates include maple and balsam fir.)

Growing stock. Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4-inch top (of central stem) inside bark. The volume of this material is also measured in standard cords, outside bark.

Growth.

Net annual growth of sawtimber. The change during a specified year in net board-foot volume of live sawtimber resulting from natural causes exclusive of catastrophic losses.

Net annual growth of growing stock. The change during a specified year in net cubic-foot volume of growing stock resulting from natural causes exclusive of catastrophic losses. Also given in standard cords.

Ingrowth of sawtimber. The net volume of trees that reach minimum sawtimber size (eastern softwoods, 9.0 inches d.b.h.; western softwoods and all hardwoods 11.0 inches d.b.h.) during a specified year.

Ingrowth of growing stock. The net volume of trees that reach minimum poletimber size (5.0 inches d.b.h.) during a specified year.

Gross growth. Net annual growth plus annual mortality.

Needed growth. The net annual growth of timber on commercial forest land which would meet a specified future level of wood requirements plus a margin for catastrophic losses, national emergencies, and new forms of wood use. See Chapter VII, "Future Supply and Quality of Domestic Timber," for further explanation.

Realizable growth. The net annual growth of timber on an area of commercial forest land which it would be practical to attain if all the land is managed as intensively as is justified under specified assumptions as to future prices and other economic conditions. See Chapter VII, "Future Supply and Quality of Domestic Timber," for further explanation.

Growth deficiency. See "growth impact."

Growth impact. Mortality plus growth loss. See section on "Forest Protection Against Destructive Agencies" in Chapter IV, "Factors Affecting Future Supply and Quality of Domestic Timber" for further explanation.

Mortality. The net board-foot volume removed from live sawtimber, or the net cubic-foot volume removed from growing stock, during a specified year through death from natural causes, exclusive of catastrophic losses.

Growth loss. Growth deficiency plus loss of accumulated growth.

Growth deficiency. Timber loss due to (a) delay in restocking or deficiencies in stocking resulting from causes such as attack by insects, disease or animals or fire or adverse weather effects, and (b) the reduction in growth due to changes in timber type, defoliation, reduction of tree vigor, increase in cull percent, or deterioration of site due to such destructive agents.

Loss of accumulated growth. The effect on present and prospective yields of live sawtimber or growing stock due to mortality (caused by such agents as fire, insects, disease, animals and adverse weather) of poletimber trees, saplings and seedlings in the case of sawtimber yields, and saplings and seedlings in the case of growing stock yields.

Hardwood limbs. The limbs of live sawtimber hardwood trees and sawtimber size cull hardwood trees to a minimum diameter of 4.0 inches inside bark.

Hardwoods. In the United States and Coastal Alaska, dicotyledonous (usually broadleaved and deciduous) trees of commercial species. (See "species groups.")

Indian ownership. See "ownership."

Industrial and other private ownership. Private ownership other than farm. Includes ownerships of the primary wood manufacturing industries.

Industrial wood. Timber products other than fuelwood.

Interplanting. See "planting."

Land area. Includes dry land and land temporarily or partially covered by water, such as marsh lands, swamps, and river flood plains (omitting tidal flats); streams, sloughs, estuaries, and canals less than one-eighth of a statute mile in width; and lakes, reservoirs, and ponds having less than 40 acres of area.

Forest land. See "forest land area".

Cropland in farms. Includes cropland harvested, cropland not harvested and cropland not pastured, as defined in the 1950 Census of Agriculture as follows:

Cropland harvested. This includes land from which crops were harvested; land from which hay (including wild hay) was cut; and land in small fruits, orchards, vineyards, nurseries and greenhouses;

Cropland not harvested and not pastured. This includes idle cropland; land in soil-improvement crops only; land on which all crops failed; land seeded in crops for harvest after 1949; and cultivated summer fallow.

Pasture and range in farms. Includes cropland used only for pasture and other pasture defined in the 1950 Census of Agriculture as follows:

Cropland used only for pasture. Includes rotation pasture and all other cropland that was used for pasture.

Other pasture. Includes rough and brush land pastured and any other land pastured excepting woodland and cropland.

Pasture and range not in farms. Nonforest land not in farm ownership that is grazed. Confined almost entirely to lands in public ownership.

Other land. This item includes all house lots, barn lots, lanes, roads, ditches, power lines, etc.. It includes all nonforest land which is not included in any of the other specified land-use classes.

Log Grades. Criteria for describing the relative quality of a log or for classifying a given volume of sawtimber according to the quality of its sawlog components. The log grades used in this report are those developed for (1) eastern hardwood sawlogs suitable for standard lumber and (2) southern pine sawlogs suitable for yard lumber.

For eastern hardwoods three standard lumber log grades are used: Grade 1 logs, studies have shown, yield about 65 to 80 percent of their volume in No. 1 Common and Better grades of lumber, Grade 2 logs yield about 40 to 64 percent, and Grade 3 logs yield only about 13 to 36 percent No. 1 Common and Better lumber. Included with the volume of Grade 3 standard lumber logs is the volume of hardwood logs which are not suitable for standard lumber but which are suitable for ties and timbers. (See Chapter II, table 22, page 59.) Detailed specifications for hardwood log grades are given in the following publication:

U. S. Forest Serv., Forest Products Lab. Hardwood Log Grades for Standard Lumber and How to Apply Them. Multil. Release D1737-A. 16pp., illus. Madison, Wis., 1949.

For the southern yellow pines, four lumber grades, based on yard lumber specifications, are used: Average Grade 1 logs, according to one recent study, yield over 50 percent B and Better lumber, Grade 2 logs 30 to 50 percent, Grade 3 logs 13 to 17 percent, and Grade 4 logs only 1 to 4 percent B and Better lumber. Grade specifications can be found in:

U. S. Forest Serv. Interim Log Grades for Southern Pine. Multil., 18 pp., illus. 1953.

Logging residues.

Logging residues from live sawtimber. The net board-foot volume of live sawtimber trees cut or killed by logging and not converted to timber products.

Logging residues from growing stock. The net cubic-foot volume of live sawtimber and poletimber trees cut or killed by logging and not converted to timber products. Also given in standard cords.

Loss of accumulated growth. See "growth impact."

Lumber manufacturer. See "ownership."

Merchantable top (sawtimber trees). The point on the bole of sawtimber trees above which a minimum merchantable sawlog as defined regionally cannot be produced.

Mortality, annual.

Annual mortality of sawtimber. The average annual net board-foot volume removed from live sawtimber during a specified period through death from natural causes, exclusive of catastrophic losses.

Annual mortality of growing stock. The average annual net cubic-foot volume, removed from growing stock during a specified period through death from natural causes, exclusive of catastrophic losses. Also given in standard cords.

National forest ownership. See "ownership."

Net volume.

Net volume in board feet. Gross volume in terms of the International 1/4-inch log rule less deductions for rot, sweep, and other defects affecting use for lumber.

Net volume in cubic feet. Gross volume in cubic feet less deductions for rot. Also reported in standard cords of 128 cubic feet, including bark.

Noncommercial forest land area. See "forest land area."

Nonforest land area. Land that does not qualify as forest land. The minimum area recognized as nonforest land is one acre in the East and 10 acres in the West. Unimproved roads, streams, canals, rights-of-way, clearings, and treeless strips must be at least 120 feet wide to qualify as nonforest land. Improved roads, regardless of width, will be classified as nonforest land. Includes land which has never supported forest growth; land which is less than 10 percent stocked with forest trees and which has been developed for other use, such as grazing, agricultural, residential, or industrial; all land in thickly populated urban and suburban areas, and water classified by the Bureau of the Census as land. See "land area" and "forest land area."

Nonstocked area. See "stocking."

Old-growth sawtimber stands. Sawtimber stands in which over 50 percent of the net board-foot volume is in old-growth sawtimber trees.

Open area planting. See "planting."

Operating area. (1) The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done between January 1, 1947, and date of examination, 1952-1954. (2) The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. See the section on "Condition of Recently Cutover Land" in Chapter IV, "Factors Affecting Future Supply and Quality of Domestic Timber," for further explanation.

Other Federal ownership. See "ownership."

Other land. See "land area."

Other private ownership. See "ownership."

Other wood manufacturer. See "ownership."

Owner. The person or group of persons in whom is vested the title of a particular property.

Ownership. The property owned by one owner, regardless of the number of parcels that it may consist of, in a specified area such as a state, region, or section, or in the United States and Coastal Alaska as a whole.

Ownership classes. A classification of property based on the following types of ownership:

Federal ownership or trusteeship. Property owned or administered by the Federal government. Includes the following types of ownership:

National forest. Federal property which, by executive order or statute, has been designated as a national forest, purchase unit, or experimental area or Federal property administered in conjunction with the national forests.

Indian. Indian tribal property or trust allotments, i.e. real estate held in fee by the Federal government but administered and managed for Indian tribal groups, or allotted in trust to individual Indians.

Bureau of Land Management. Federal property administered by the Bureau of Land Management in the U. S. Department of the Interior.

Other Federal. Other property owned or administered by the Federal government.

State ownership. Property in State ownership or under lease to a State for 50 years or more.

County and municipal ownership. Property in county, municipal or other local public ownership.

Private ownership. Property in one of the following types of private ownership:

Farm. Land in farms as defined by the Census of Agriculture, with these exceptions: (a) Indian reservation farms (classified as land in Federal ownership or trusteeship), (b) public institutional, experiment station, and other public land in farms (classified as land in specified public ownership), (c) certain large acreages of grazing lands in the West, leased from railroads or other non-farmers without transfer of timber cutting rights to the lessee (classified as land in forest industry or other private ownership).

In the 1950 Census of Agriculture, a farm was a place of three or more acres producing agricultural products in 1949, exclusive of home gardens, valued at $150 or more. The agricultural products could have been either for home use or for sale. Places of less than three acres were counted as farms only if the value of sales of agricultural products in 1949

Private ownership (continued)

Farm.(continued) amounted to $150 or more. Places operated in 1949 for which the value of agricultural products in 1949 was less than these minima because of crop failure or other unusual situation, and places operated in 1950 for the first time were counted as farms if normally they could be expected to produce these minimum quantities of farm products.

All the land under the control of one person or partnership, through ownership, lease, rental or cropping arrangement, was included as one farm ownership.

Commercial forest land in farms is not the same as woodland in farms as reported by the Census. Part of the difference is due to the exceptions to land in farms, stated above. However, the major part of the difference arises because some of the woodland in farms is noncommercial forest land. In some cases, lands that qualify as commercial forest land were classed as pasture or waste lands by the Census.

Forest industries. (Also termed primary wood manufacturing industries or wood using industries). Property of forest owners who operate primary wood processing plants and who apparently obtain more of their income from the sale of wood products than from any other single source, or who operate wood processing subsidiary corporations that derive income chiefly from the sale of wood products. Includes industries comprised of the following kinds of manufacturers:

Lumber manufacturer. A forest owner who manufactures lumber and who uses a greater cubic volume of timber from his land for this purpose than in any other type of primary wood-processing plant that he may operate.

Pulp manufacturer. A forest owner who manufactures pulp and who uses a greater cubic volume of timber from his land for this purpose than in any other type of primary wood-processing plant that he may operate.

Other wood manufacturer. A forest owner who manufactures veneer, cooperage or other wood products except pulp and lumber.

Other private ownership. Private property, other than that classified as farm or forest industry ownership, such as property owned by business and professional persons, wage earners, housewives, retired persons, nonforest industries, estates, and dealers in forest land.

Ownership size classes. A classification of private commercial forest land based on the acreage of commercial forest land in an ownership, regardless of the number of tracts that comprise it. Synonymous with "size class of owner" or "owner size class."

Small. An ownership of less than 5,000 acres of commercial forest land. Ownerships of less than 3 acres in the East and of less than 10 acres in the West were not enumerated, nor was the productivity of their cutover lands determined, though their acreage is included in the commercial forest area of small ownerships.

Medium. An ownership of 5,000 to 50,000 acres of commercial forest land.

Large. An ownership of 50,000 or more acres of commercial forest land.

Pasture and range. See "land area."

Physical-structure raw materials. All raw materials other than foods, gold, and energy materials.

Plant residues. Slabs, edgings, trimmings, miscuts, cull pieces, veneer cores, sawdust, shavings, wood substance lost in barking, chipper rejects and screenings at pulp mills, veneer clippings and other residues developed from logs, bolts and other round timber in the primary manufacturing process, excluding lignin and various dissolved wood substances incurred in pulp manufacture.

Plantable area. Nonstocked or poorly stocked forest land or nonforest land on which (a) the establishment or interplanting of forest tree cover is desirable and practical, and on which (b) forest tree regeneration will not occur naturally in desirable density within a reasonable period of time.

Total plantable area. Plantable area at a specified time plus area of acceptable plantations established prior to that time.

Plantation. An area on which forest tree cover (and/or shrub cover in the case of shelterbelts) has been established by planting.

Acceptable plantation. A plantation that has at least the following number of planted forest trees per plantation acre at the end of the fifth year after planting.

All eastern species	400 trees
Englemann spruce and lodgepole pine	300 trees
Other western species	200 trees

Shelterbelt. A plantation of trees and/or shrubs established to serve as a windbreak to prevent wind erosion, to protect farm buildings, and to otherwise moderate the microclimate.

Planting. The establishment of tree cover (and/or shrub cover in the case of shelterbelts) by setting nursery stock in the ground or by direct seeding.

Open area planting. Planting of nonstocked forest land or non-forest land.

Interplanting. Planting of poorly stocked forest land.

Planting success. The area of acceptable plantations divided by the total area planted.

Poletimber stands. See "stand size class."

Poletimber trees. See "tree size class."

Poorly stocked stands. See "stocking."

Productive but reserved forest land area. See "forest land area."

Productivity of recently cut land. A concept used to evaluate the conditions affecting present and prospective timber growth, on lands logged for commercial timber products between January 1, 1947 and date of examination, 1952-1954, in relation to standards of stocking, species composition, and felling age adjudged currently attainable and practical under local conditions. Full explanation is given in the section "Condition of Recently Cutover Lands" in Chapter IV, "Factors Affecting Future Supply and Quality of Domestic Timber."

Pulp manufacturer. See "ownership."

Realizable growth. See "growth."

Recently cut land. See "operating area."

Relative consumption. See "consumption."

Requirements for timber. Potential demand for timber products, under specified assumptions, at some future date. See Chapter VI, "Future Domestic Requirements for Timber," for explanation.

Reserved forest land area. See "forest land area."

Rotten cull trees. See "cull trees."

Roundwood. The cubic volume of logs, bolts and other round sections as they are cut from the tree.

Salvable dead trees. Standing or down dead trees which are considered merchantable by regional standards.

Sampling error. The error of an estimated total or average that arises from taking a sample rather than making a complete inventory or measurement. In this Review, sampling errors do not include bias due to errors in photo classification of areas, mapping, measuring volume, tabulation, computation, and compilation, that could arise whether sampling is used or not.

Sawlog portion. The portion of sawtimber trees between stump and merchantable top.

Sawtimber stands. See "stand size class."

Sawtimber trees. See "tree size class."

Sawtimber volume.

Live sawtimber volume. Net volume in board feet, International 1/4-inch rule, of live sawtimber trees of commercial species.

Salvable dead sawtimber volume. Net volume in board feet, International 1/4-inch rule, of salvable dead sawtimber trees of commercial species.

Seedling and sapling stands. See "stand size class."

Seedlings and saplings. See "tree size class."

Shelterbelt. See "plantation."

Size class of owner. See "ownership size classes."

Size of holding. See "ownership size classes."

Softwoods. In the United States and Coastal Alaska, coniferous, evergreen (except larches and baldcypress) trees of commercial species. (See "species groups.")

Sound cull trees. See "cull trees."

Species groups.

Eastern softwoods:

Longleaf and slash pines
Shortleaf and loblolly pines
Other southern yellow pines
Spruce and balsam fir
White and red pines
Jack pine
Hemlock
Cypress
Other eastern softwoods

Eastern hard hardwoods. Hardwood species whose wood has an average hardness index value of more than 80 as listed in table 1 of "Comparative Strength Properties of Woods Grown in the United States," U. S. Dept. Agr. Tech. Bul. 158, 1930. Included are:

White oaks (*Quercus alba* and *Q. prinus*)
Other white oaks
Red oaks (*Q. borealis* and *Q. falcata* var. *pagodaefolia*)
Other red oaks
Yellow birch
Sugar maple
Beech
Ash
Hickory
Black walnut
Other hard hardwoods

Eastern soft hardwoods. Hardwood species whose wood has an average hardness index value of 80 or less as listed in table 1 of "Comparative Strength Properties of Woods Grown in the United States," U. S. Dept. Agr. Tech. Bul. 158, 1930. Included are:

Soft maple
Sweetgum
Tupelo and blackgum
Cottonwood and aspen
Basswood
Yellow poplar
Other soft hardwoods

Western softwoods:

Douglas-fir
Ponderosa and Jeffrey pines
True firs
Western hemlock
Sugar pine
Western white pine
Redwood
Sitka spruce
Englemann and other spruces
Western larch
Western redcedar
California incense cedar
Lodgepole pine
Other western softwoods

Western hardwoods:

Aspen
Red alder
Other western hardwoods

Stand improvement measures. Measures, such as pruning, release cutting, girdling, weeding, or poisoning of cull trees, applied with purposeful intent to improve growing conditions in either natural or planted stands, but which do not result in the production of commercial timber products.

Stand size class.

Sawtimber stands. Stands of sawtimber trees having a minimum net volume per acre of 1,500 board feet, International 1/4-inch rule, except in softwood types in the Douglas-fir subregion of the Pacific Northwest and in California west of the Sierras where the minimum net volume per acre is 4,000 board feet, International 1/4-inch rule.

Poletimber stands. Stands failing to meet the sawtimber stand specifications, but at least 10 percent stocked with poletimber and larger trees and with at least half this minimum stocking in poletimber trees.

Seedling and sapling stands. Stands not qualifying as sawtimber or poletimber stands, but at least 10 percent stocked with trees and with at least half this minimum stocking in seedlings or saplings.

Nonstocked and other areas. Areas not qualifying as sawtimber, poletimber, or seedling and sapling stands.

Standard error. The range about a sample estimated average or total, within which the odds are 2 to 1 that the average or total based on complete coverage (100 percent sample) would fall.

State ownership. See "ownership."

Stocking. Stocking is the extent to which growing space is effectively utilized by present or potential growing stock trees of commercial species. Degree of stocking is synonymous with "percent of growing space occupied" and means the ratio of actual stocking to full stocking for comparable sites and stands. Stocking may be measured in terms of number of trees, volume, basal area, cover canopy, or other criterion, or combination of criteria.

Non-stocked areas. Areas that are 0 to 10 percent stocked with present or potential growing stock trees.

Poorly stocked stands. Stands that are 10-39 percent stocked with present or potential growing stock trees.

Well and medium stocked stands. Stands that are 40 percent or more stocked with present or potential growing stock trees.

Timber cut.

Timber cut from live sawtimber. The net board-foot volume of live sawtimber trees cut or killed by logging during a specified year.

Timber cut from growing stock. The net cubic-foot volume of live sawtimber and poletimber trees cut or killed by logging during a specified year. Also given in standard cords.

Timber products output. The volume of timber products cut from growing stock on commercial forest land and from other sources such as cull trees, salvable dead trees, limbs, saplings, material less than 4 inches in diameter, timber on noncommercial and nonforest lands, and plant residues. Timber products include sawlogs, veneer logs and bolts, cooperage logs and bolts, pulpwood, fuelwood, piling, poles, posts, hewn ties, mine timbers, and various other round, split or hewn products.

Tract. A single parcel of land that is not contiguous to any other parcel in the same ownership, and that includes one or more areas of commercial forest land.

Tree size class. Any one of the following tree classes in which the trees are grouped chiefly according to diameter at breast height (4-1/2 feet above the ground), outside bark:

Sawtimber trees. Trees of commercial species that contain at least one merchantable sawlog as defined by regional practice and which are of the following minimum diameters at breast height:

Eastern regions: Softwoods 9.0 inches
Hardwoods 11.0 inches.

Western regions: All species 11.0 inches.

Poletimber trees. Trees of commercial species which meet regional specifications of soundness and form, and which are of the following diameters at breast height:

Eastern regions: Softwoods 5.0 to 9.0 inches
Hardwoods 5.0 to 11.0 inches

Western regions: All species 5.0 to 11.0 inches.

Seedling and sapling trees. Live trees of commercial species, less than 5.0 inches in diameter at breast height, and of good form and vigor.

Unproductive forest land area. See "forest land area."

Upper stem portion (sawtimber trees). The portion of sawtimber trees between merchantable top and a point on the bole with a minimum top 4.0 inches in diameter inside bark when it exists.

Well and medium stocked stands. See "stocking."

Wood using industries. See "ownership."

Young-growth sawtimber stands. Sawtimber stands in which 50 percent or more of the net board-foot volume is in young-growth sawtimber trees.

TIMBER RESOURCE REVIEW

CHAPTER IX. A P P E N D I C E S

C. CONVERTING FACTORS

(Preliminary review draft subject to revision)

By:

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September, 1955

Contents

CONVERTING FACTORS

In dealing with timber volume or volume of different timber products, three types of converting factors are commonly used: (1) Forest Resource factors to convert inventory volume from one unit of measurement to another such as board feet to cubic feet, and cubic feet to cords; (2) Roundwood factors to convert board foot volumes of logs and bolts measured by a given log rule to equivalent volume by another, or to convert quantity units such as pieces to cubic feet, cords or board feet; and (3) Utilization factors to show volume of growing stock (live sawtimber and poletimber trees) cut per unit of output of various timber products.

The three sets of converting factors presented here are applicable on a sectional or broad regional basis and denote average relationships derived from the factors in use in different parts of the country.

FOREST RESOURCE FACTORS

Forest resource factors compare (a) inventory volume in board feet by the International $\frac{1}{4}$-inch log rule for sawtimber trees with the corresponding cubic foot volume, including both the sawlog and upper stem portions, and (b) the cubic foot-cord relationships applicable to total growing stock consisting of live sawtimber and pole-timber trees.

Sawtimber

	Cubic feet per M board feet (International $\frac{1}{4}$-inch log rule)		
	All species	Softwood	Hardwood
North	219	241	213
South	205	195	216
West	171	170	219
Continental U. S.	184	173	215

Growing Stock

	Cubic feet per cord		
	All species	Softwood	Hardwood
North	76	79	75
South	71	74	69
Average East	73	75	72

Roundwood factors compare the various round timber products in units of measure as customarily reported by the Bureau of the Census, the trade and other sources with the corresponding roundwood volumes of the logs or bolts from which the product came, expressed in (a) board feet International $\frac{1}{4}$-inch log scale, (b) cubic feet excluding bark, and (c) standard cords (128 cubic feet) including bark. They apply to all logs and bolts used for particular products whether the trees from which they were cut were live or dead, classed as culls, or were from commercial forest, noncommercial forest, or nonforest land.

All the various products, except hewn ties, are originally reported as either logs, bolts, cordwood or other round timber, but their volume is given in different units of measure. Thus appropiate converting factors are needed to translate these various volumes in common units to standard units of measure so that any one may be properly compared with any other, or that all may be combined and treated as a group. Sawlogs for lumber for example, are commonly reported in board feet lumber tally; whereas veneer logs and bolts and cooperage logs and bolts are reported in board feet log scale according to various log rules, - Doyle, Scribner, Spaulding - depending on local practice. Pulpwood and fuelwood statistics commonly are reported in standard rough cords (128 cu. ft.), poles, posts and hewn ties in number of pieces, piling in linear feet, and mine timbers and miscellaneous round timbers in cubic feet.

Sawlogs, veneer logs and bolts, and cooperage logs and bolts

Sawlogs:	Board feet (International ¼-inch log rule) per M board feet lumber tally		
	All species	Softwood	Hardwood
North	937	927	943
South	994	984	1,014
West	967	968	872
Continental U. S.	973	970	983

	Board feet (International ¼-inch log rule) per M board feet local log rule 1/		
Veneer logs and bolts:	All species	Softwood	Hardwood
North	1,077	1,076	1,077
South	1,293	1,294	1,293
West	1,048	1,048	..
Continental U. S.	1,122	1,054	1,238
Cooperage logs and bolts:			
North	1,174	1,000	1,200
South	1,412	1,409	1,414
West	1,052	1,052	..
Continental U. S.	1,314	1,301	1,320

1/ Local log rule: North and South principally Doyle; West mostly Scribner.

Sawlogs, veneer logs and bolts,
and cooperage logs and bolts
(continued)

	Cubic feet per M board feet lumber tally		
Sawlogs:	All species	Softwood	Hardwood
North	155	169	149
South	162	164	156
West	151	151	141
Continental U. S.	156	156	153

	Cubic feet per M board feet local log rule 1/		
	All species	Softwood	Hardwood
Veneer logs and bolts:			
North	165	171	165
South	196	199	196
West	159	159	..
Continental U. S.	170	160	188
Cooperage logs and bolts:			
North	185	235	178
South	220	235	209
West	159	159	..
Continental U. S.	205	224	195

1/ Local log rule: North and South principally Doyle; West mostly Scribner.

Sawlogs, veneer logs and bolts, and cooperage logs and bolts (continued)

	Cubic feet per M board feet International $\frac{1}{4}$-inch log rule		
	All species	Softwood	Hardwood
Sawlogs:			
North	166	182	158
South	163	167	154
West	156	156	162
Continental U. S.	160	161	156
Veneer logs and bolts:			
North	153	159	153
South	152	154	152
West	152	152	..
Continental U. S.	152	152	152
Cooperage logs and bolts:			
North	158	235	148
South	156	167	148
West	151	151	..
Continental U. S.	156	172	148

Pulpwood and Fuelwood

	Cubic feet per cord		
	All species	Softwood	Hardwood
Pulpwood:			
North	78	79	74
South	73	72	79
West	90	90	90
Continental U. S.	77	77	77
Fuelwood:			
North	69	67	69
South	77	77	77
West	84	86	73
Continental U. S.	75	78	73

	Board feet (International $\frac{1}{4}$-inch rule) per cord 1/		
	All species	Softwood	Hardwood
Pulpwood:			
North	150	200	100
South	147	145	163
West	488	488	393
Continental U. S.	204	217	128
Fuelwood:			
North	110	95	110
South	179	157	188
West	414	426	273
Continental U. S.	163	177	159

1/ A cord of pulpwood and fuelwood ordinarily contains material from both sawtimber and poletimber trees. These factors show the board foot volume, according to inventory standards, of the sawtimber material in the average cord.

Poles and Piling

Poles:	Cubic feet per piece		
	All species	Softwood	Hardwood
North	8.3	8.3	4.0
South	12.5	12.5	11.8
West	18.6	18.6	..
Continental U. S.	13.5	13.6	11.1

	Board feet (International $\frac{1}{4}$-inch log rule) per piece		
	All species	Softwood	Hardwood
North	26.0	26.0	..
South	66.0	66.0	..
West	88.0	88.0	..
Continental U. S.	69.0	69.0	..

Piling:	Cubic feet per linear foot		
	All species	Softwood	Hardwood
North	0.63	0.63	0.62
South	.68	.68	.69
West	.75	.75	.62
Continental U. S.	.68	.69	.62

	Board feet (International $\frac{1}{4}$-inch log rule) per linear foot		
	All species	Softwood	Hardwood
North	3.14	3.06	3.26
South	3.58	3.58	3.34
West	4.66	4.66	..
Continental U. S.	3.67	3.70	3.26

Posts and Hewn ties

	Cubic feet per piece		
	All species	Softwood	Hardwood
Posts:			
North	0.59	0.62	0.59
South	.64	.63	.65
West	.98	.98	.99
Continental U. S.	.63	.67	.62
Hewn ties 1/:			
North	4.99	..	4.99
South	6.66	6.26	6.90
West	..	..	..
Continental U. S.	6.62	6.25	6.83

1/ The average hewn tie contains about 3.32 cubic feet and 38.6 board feet. A log or bolt to produce the final product contains, on the average, approximately double this volume in cubic feet but roughly the same volume in board feet log scale.

Mine timbers and Miscellaneous

	Board feet (International ¼-inch rule) per cubic foot		
	All species	Softwood	Hardwood
Round Mine Timbers:			
North	1.15	2.80	1.01
South	1.22	1.36	1.15
West	2.77	2.77	..
Continental U. S.	1.35	2.43	1.04
Miscellaneous:			
North	3.08	2.74	3.11
South	3.05	1.58	3.72
West	5.12	5.12	..
Continental U. S.	3.57	3.70	3.48

Utilization factors show the volume of growing stock (live sawtimber and poletimber trees) cut per unit of output of various timber products. They show, for example, how much sawtimber is cut per M board feet of lumber and the volume of growing stock cut per cord of pulpwood, including pulpwood from both round timber and plant residues.

Utilization factors are computed for 1952 on the basis of inventory standards and utilization practices prevailing in that year. Their principal function is to provide a basis, until significant changes in utilization practices occur, for estimating the cut of live sawtimber and growing stock associated with a given volume of output of timber products.

Average utilization factors for each product were estimated also for 1975 on the basis of 1952 inventory standards and future utilization practices indicated by probable future trends in the various regions. They appear in Chapter VII, Future Supply and Quality of Domestic Timber, as indexes showing deviations from 1952. The indexes were used to translate projected levels of requirements for timber products in 1975 to timber cut from domestic forests.

Part of the growing stock that is cut for timber products is not being used. Varying amounts are left as residues depending on the product. The growing stock inventory consists of the net volume of sound material in sawtimber and poletimber trees measured in board feet International $\frac{1}{4}$-inch log scale for the sawlog portion of sawtimber trees, and in cubic feet for entire trees to a minimum top of 4 inches d.i.b. The sawlog portion corresponds to top merchantability limits and quality standards consistent with defined utilization practices in various regions.

In terms of inventory standards there is under-utilization if any sound merchantable material classed as growing stock is left unused, whether felled purposely or knocked down or killed in logging. There are also instances of over-utilization of growing stock, both in board feet and cubic feet. For example, parts of the stem above the recognized sawlog portion may be cut for lumber and thus represent over-utilization in board feet. In this instance all the material utilized is charged as timber cut in cubic feet but only the volume represented by the sawlog portion is charged as timber cut in board feet. Likewise pulpwood cutting might extend above the minimum 4-inch top in which case over-utilization in cubic feet results. The excess in this instance is not levied against growing stock but shows up as being production from other sources.

In all regions there is both under and over utilization because of the varying practices of logging operators. The practice of over-utilization of growing stock is more prevalent in the North and South than in the West since the volume would need to be much more substantial to offset the presently large volumes of residues developed from logging in these areas.

The fact that less than a thousand feet of sawtimber on the average is required for a thousand feet of lumber simply means, for one thing, that some production comes from material below minimum size and quality, by inventory standards, in sawtimber trees and from sources other than growing stock, such as cull and dead trees, trees from noncommercial forest and nonforest land, and that this additional output in itself may be enough to more than compensate for the volume of growing stock residues left in the woods.

There are a number of other factors that may also contribute to this favorable growing stock-output relationship. For instance, lumber tally overruns International $\frac{1}{4}$-inch log scale an average of about 3 percent. More board feet of lumber therefore is cut from sawlogs on the average than is scaled by the International log rule.

Differences (overrun) between Reported Lumber Tally and International $\frac{1}{4}$-inch Log Scale.

	Percent
North	6.7
South	0.6
West	3.4
All Regions	2.8

However, in the case of veneer logs and bolts and cooperage logs and bolts reported volumes according to various local log rules underrun International $\frac{1}{4}$-inch scale by considerable amounts.

Another reason why timber cut is less than output concerns the practice of cutting pole trees for lumber and other products generally derived from sawtimber trees. While volume cut from poletimber is credited against growing stock in cubic feet no charge is made in board feet.

Plant residues constituted part of the output of such items as pulpwood, fuelwood, posts, etc. This material which develops in the primary manufacture of lumber, veneer, and other products from logs and bolts is counted originally as growing stock cut for these items and is, therefore, not counted again for pulpwood and other products for which it subsequently may be used. In addition, considerable quantities of dead and cull timber are used for pulpwood and fuelwood. Thus growing stock cut for these particular products represents only a part of the total output of these products. The same is true in varying degree for practically all products because of the production which is derived from sources other than growing stock.

Because of the many variables affecting utilization and the difficulty of accurately adjusting inventory standards to conform with changing utilization practices it can be readily appreciated that factors denoting the cut of growing stock per unit of the various timber products mught logically differ from one section of the country to another.

Volume of live sawtimber and growing stock cut per unit of timber product output (utilization factors) 1952[1]

CONTINENTAL UNITED STATES

Product	Unit of output	Sawtimber				Growing stock	
		Softwood		Hardwood		Softwood	Hardwood
		Bd. Ft.[2]	Cu. Ft.	Bd. Ft.[2]	Cu. Ft.	Cu. Ft.	Cu. Ft.
Sawlogs	M bd. ft. lumber tally	917	161	968	189	166	201
Veneer logs and bolts	M bd. ft. log scale[3]	1,018	162	1,335	259	162	262
Cooperage logs and bolts	M bd. ft. log scale[3]	1,215	229	1,571	317	245	319
Pulpwood	Standard cord	198	41	121	28	68	73
Fuelwood	Standard cord	20	5	61	14	8	28
Piling	Linear foot	3.90	.76	3.43	.72	.79	.73
Poles	Piece	72.5	14.2	68.7	10.7	15.7	10.7
Posts	Piece	.67	.14	.73	.14	.48	.40
Hewn ties	Piece	41.0	8.56	51.1	11.50	8.59	11.85
Round mine timbers	Cu. Ft.	2.20	.46	.95	.23	1.02	.93
Other	Cu. Ft.	1.91	.34	2.63	.57	.53	.85
NORTH							
Sawlogs	M bd. ft. lumber tally	805	168	901	160	182	179
Veneer logs and bolts	M bd. ft. log scale[3]	1,144	199	1,151	203	199	206
Cooperage logs and bolts	M bd. ft. log scale[3]	565	142	1,284	215	237	216
Pulpwood	Standard cord	183	41	93	22	76	78
Fuelwood	Standard cord	12	4	35	8	10	23
Piling	Linear foot	3.24	.70	3.46	.72	.70	.72
Poles	Piece	27.9	6.1	0	0	10.0	0
Posts	Piece	.41	.11	.55	.12	.43	.36
Hewn ties	Piece	..	..	34.0	6.14	..	6.14
Round mine timbers	Cu. Ft.	2.28	.64	.92	.22	.94	.91
Other	Cu. Ft.	2.40	.54	1.83	.38	.98	.64

Volume of live sawtimber and growing stock cut per unit of timber product output (utilization factors) 1952 (continued)

SOUTH

Product	Unit of output	Sawtimber				Growing stock	
		Softwood		Hardwood		Softwood	Hardwood
		Bd. Ft.[2]	Cu. Ft.	Bd. Ft.[2]	Cu. Ft.	Cu. Ft.	Cu. Ft.
Sawlogs	M bd. ft. lumber tally	910	174	1,014	209	185	216
Veneer logs and bolts	M bd. ft. log scale[3]	1,140	248	1,398	278	248	281
Cooperage logs and bolts	M bd. ft. log scale[3]	1,384	262	1,796	397	267	400
Pulpwood	Standard cord	132	31	138	33	65	66
Fuelwood	Standard cord	39	10	82	20	18	32
Piling	Linear foot	3.74	.76	3.47	.74	.80	.80
Poles	Piece	69.0	14.1	75.5	11.8	14.7	11.8
Posts	Piece	.22	.06	.97	.18	.46	.46
Hewn ties	Piece	41.0	8.57	51.9	11.73	8.60	12.09
Round mine timbers	Cu. Ft.	1.41	.31	1.16	.33	1.06	1.06
Other	Cu. Ft.	1.37	.29	3.24	.73	.79	1.02

WEST

Product	Unit of output	Sawtimber Softwood Bd. Ft.[2]	Sawtimber Softwood Cu. Ft.	Sawtimber Hardwood Bd. Ft.[2]	Sawtimber Hardwood Cu. Ft.	Growing stock Softwood Cu. Ft.	Growing stock Hardwood Cu. Ft.
Sawlogs	M bd. ft. lumber tally	932	153	855	148	155	148
Veneer logs and bolts	M bd. ft. log scale[3]	1,015	160	..	..	160	..
Cooperage logs and bolts	M bd. ft. log scale[3]	972	149	..	..	149	..
Pulpwood	Standard cord	406	67	581	96	69	97
Fuelwood	Standard cord	7	1	24	4	1	8
Piling	Linear foot	4.99	.83	0	0	.83	0
Poles	Piece	94.4	16.0	0	0	20.9	0
Posts	Piece	3.24	.56	.15	.02	.73	.03
Hewn ties	Piece	..	..	..	..	..	..
Round mine timbers	Cu. Ft.	2.51	.44	0	0	1.05	0
Other	Cu. Ft.	2.08	.35	5.45	1.25	.42	1.46

1/ See Chapter VII, Future Supply and Quality of Domestic Timber, for average utilization factors estimated for 1975 (Continental United States).

2/ International $\frac{1}{4}$-inch log scale

3/ In common use locally

TIMBER RESOURCE REVIEW

CHAPTER IX. A P P E N D I C E S

D. SAMPLING STANDARDS

(Preliminary review draft subject to revision)

By:

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September, 1955

Contents

SAMPLING STANDARDS

INTRODUCTION

The purpose of this discussion of sampling standards is to evaluate the reliability of Timber Resource Review statistics with respect to sampling accuracy.

Sampling procedures were employed in estimating forest area, inventory volume, net annual growth, timber products output, area by productivity class based on examination of recently cutover lands, number of private ownerships having less than 5,000 acres of commercial forest, and related items.

Sampling procedures were designed with the objective of providing estimates of adequate reliability, for the use intended, at the lowest cost. For all items listed above except number of ownerships, sampling accuracy goals were set and the amount of sampling and the methods used were aimed at providing estimates that met those goals. In addition, the methods of sampling employed permitted calculation of the sampling accuracies actually achieved for most of the estimates.

In the following tables, the sampling errors are listed for major items by States and/or regions and sections. Charts provide a means of approximating the sampling accuracies of further breakdowns of statistics.

Sampling accuracy is expressed in terms of the standard error, which indicates the range about the sample-estimated average or total within which the odds are 2 to 1 that the average or total based on 100 percent coverage would fall.

The accuracy statistics given in the tables account only for sampling error, that is, the errors that arise from taking a sample rather than making a complete inventory or measurement. They do not include nonsampling errors that could arise from sources such as errors in photo classification of areas, mapping, measuring volumes, tabulation, computation, and compilation. To the extent that nonsampling errors are not compensating, they contribute an additional but unknown amount of error to those listed herein. Such additional error is termed bias. It is not affected by the amount of sampling done and will tend to bias a complete survey to the same degree as a sample. An unbiased sample estimate has an equal chance of being either high or low. Chances of introducing bias in statistics were reduced by employing unbiased methods of selecting sample areas, ownerships, and operations, by preparation of detailed plans, by training of survey personnel, and by careful checking on execution of plans.

SAMPLING ACCURACIES ACHIEVED

Area and Inventory Volume

Sampling errors in table 1 include those that apply to estimates of forest area, commercial forest area, noncommercial forest area,

inventory volume, and growth, by section, region, State, and totals for continental United States and Coastal Alaska.

The 18 States in the East covered by Forest Survey since January 1, 1947, are indicated as Group I States in table 1. The sampling accuracy for these States averaged 2.2 percent per million acres of commercial forest land. The goal in these States was 3.0 percent per million acres. Sampling error of cubic volume averaged 4.7 percent per billion feet compared to the goal of 5.0 percent.

In two States in the West completed by Forest Survey since January 1, 1947, the sampling accuracy of commercial forest area estimates averaged 2.4 percent per million acres compared to the goal of 3.0 percent. Cubic volume accuracy was 12.9 percent compared to the goal of 10.0 percent per billion cubic feet set for these Group I States in the West.

States in which Forest Survey coverage was sufficiently advanced to extend estimates to the whole State are indicated as Group II States in table 1. The accuracy goal for Group II States varied from 3 to 4.5 percent per million acres of commercial forest land, and from 5 to 12.5 percent per billion cubic feet. In two Group II States for which sampling accuracy was computed, North Carolina and Virginia, the commercial forest area sampling accuracy averaged 4.9 percent per million acres compared to the goal of 4.5 percent; cubic volume sampling accuracy averaged 7.6 percent per billion feet compared to the goal of 7.5 percent.

On the basis of the above comparisons for 22 States, it is believed that accuracy goals in the remaining 26 States indicated as Group III in table 1 were likewise achieved satisfactorily and the sampling errors are entered in table 1 on this basis. Accuracy goals for Group III States were generally set at 6 percent per million acres of commercial forest, and varied from 10 to 15 percent per billion cubic feet.

Breakdowns of Commercial Forest Area

The sampling accuracy of breakdowns of commercial forest area by stand-size class, stocking class, and timber type group can be estimated by use of the relationship to the sampling accuracy of totals shown in figure 1. Figure 1 does not apply to area breakdowns by ownership class because these areas were usually not obtained by probability sampling.

Illustrative Example

For Missouri the sampling error for commercial forest area is 0.7 percent. Of 15,064 thousand acres in commercial forest, 2,033 thousand acres is classed as sawtimber. The proportion in sawtimber stands is therefore 0.13. From figure 1 the corresponding factor is 2.8. The estimated sampling error for area in sawtimber stands is therefore 2.8 x 0.7 = 2.0 percent. Therefore the odds are 2 to 1 that the area of sawtimber as determined by a complete survey would fall in the range 1,992 to 2,074 thousand acres.

Illustrative Example

In the Middle Atlantic Region 13,948 thousand acres out of 42,225 are classed as well and medium stocked young growth sawtimber. The proportion is 0.33. Figure 1 indicates a sampling error ratio of 1.75 for this proportion. Table 1 shows a sampling error of 0.6 percent for commercial forest areas in the Middle Atlantic Region. The estimated sampling error for the breakdown being considered is therefore 1.75 x 0.6 = 1.0 percent.

Parallel procedures apply in estimating the sampling accuracy of area breakdowns by forest type groups.

Breakdowns of Inventory Volume

Table 1 provides the sampling errors of total volume by which the factors read from figure 1 are multiplied to estimate the sampling accuracy of breakdowns of volume.

Illustrative Examples of Application:

Breakdown	Proportion of total	Factor from figure 1	Sampling error of total1/ (percent)	Sampling error of breakdown2/ (percent)
State of New Hampshire:				
Softwood volume, bd. ft.	0.55	1.36	3.9	5.3
White and red pine, bd. ft.	.30	1.83	3.9	7.1
Cubic volume in pole-timber	.47	1.47	2.4	3.5
Cubic volume in soft-wood sawtimber	.30	1.83	2.4	4.4
Pacific Northwest Region:				
Douglas-fir volume, bd. ft.	.49	1.42	1.3	1.8
California Region:				
Ponderosa and Jeffrey pine, bd. ft.	.18	2.36	2.1	5.0

1/ From table 1.
2/ Product of factor and sampling error of total.

Net Annual Growth

Forest Survey reports for five States included estimates of the sampling accuracy of net annual growth. For these States the indicated sampling error per billion cubic feet of net annual growth was less than half the sampling error indicated for growing stock volume. The sampling error goals per billion cubic feet are the same for net annual growth as for

growing stock volume, and it is on this basis that sampling errors for growth are estimated for the other 43 States. While this would appear to give conservative estimates, juding from the comparison available for five States, this safety margin is adopted to make allowance for the large and usually unknown variability in the mortality component of net growth, and also for possible errors in adjusting both mortality and growth for a particular year to the trend level.

The sampling accuracy of board-foot growth was obtained by multiplying the sampling accuracy of cubic-foot growth in a State by 1.31, this ratio being based on data from States where the sampling accuracy of both board-foot and cubic-foot inventory volumes were calculated.

The procedure for estimating the sampling accuracy of breakdowns of growth is parallel to that illustrated for area and inventory volume. The steps are:

(1) Note the smallest geographic unit of which the breakdown is a part and for which the sampling accuracy is given in table 1.

(2) Compute the proportion that the breakdown contributes to the total and read from figure 1 the corresponding factor.

(3) Multiply the sampling error of the total by the factor. This product is the estimated sampling error of the breakdown.

Timber Products Output

The sampling accuracy goal for the estimate of timber products output was set at 10 percent per billion cubic feet.

Lumber accounted for more than half of the cubic volume of output from roundwood. In the West, Census data were available and were used for over-all control. Additional sampling was done to obtain estimates by States. In the East, Census data on lumber output were available too late for use in the Timber Resource Review. Data supplied by State foresters or available from various other sources, including field surveys that were undertaken where necessary, provided the needed statistics.

The sampling errors for regions and States for which the data provided a basis for computing sampling accuracy are as follows:

Sampling accuracy[1] per billion cubic feet of timber products output

Region or State:[2]	Sawlogs	Pulpwood	Veneer logs and bolts	All other products
	(percent)	(percent)	(percent)	(percent)
New England	0.7	[3] 0	1.0	2.1
Middle Atlantic	6.5	0	0	1.4
Lake States	4.0	0	0	7.6
South Atlantic	7.4	0	.8	9.8
Florida and Georgia combined	7.6	0	1.8	10.0
California	5.8	0	.8	[4] ..
Montana	1.1	0	0	9.9
Idaho	.5	0	0	17.2
Weighted average	6.3	0	1.1	9.0

1/ Sampling error in terms of one standard error.
2/ Includes all regions and States in which the sampling procedure provided a basis for calculating standard errors.
3/ Zero sampling error indicates 100 percent coverage.
4/ No basis for estimating standard error.

For other States and regions in which other than probability sampling was employed, the methods and intensity of coverage indicate that estimates of sawlog output are well within the sampling accuracy goal of 10 percent per billion cubic feet.

Estimates of pulpwood output and output of hardwood veneer logs and bolts were based on Census data of log receipts or consumption as reported by all consuming plants. Census estimates of output of softwood veneer logs and bolts were available only for plywood plants. Special surveys were therefore made of the output of logs and bolts by green veneer and container veneer plants. As indicated in the preceding tabulation, the sampling error of pulpwood output is nil and for veneer logs and bolts it is very small.

Thus, the bulk of timber products output was estimated with a small sampling error. A relatively large sampling error could therefore be tolerated for products other than sawlogs, pulpwood, and veneer logs and bolts and still be within the 10 percent sampling accuracy goal.

The estimated sampling errors for timber products output for roundwood in the United States and Coastal Alaska are shown in the following tabulation:

Average sampling accuracy[1] of timber products output from roundwood in the United States and Coastal Alaska

	Total timber products output		Sampling error per billion units	
	Billion cu. ft.	Sampling error	Cu. ft.	Bd. ft.
		(percent)	(percent)	(percent)
Product:				
Sawlogs	6.2	2.5	6.3	16.1
Pulpwood	1.8	0	0	..
Veneer logs and bolts	.4	6.4	1.1	2.8
All other products	2.7	5.6	9.0	..
Total	11.1	2.0	6.5	15.8

1/ Sampling error in terms of one standard error.

The average sampling error per billion cubic feet of timber products output is indicated as 6.5 percent. This is well within the accuracy goal of 10 percent.

For board-foot volume of sawlogs and veneer logs and bolts, the sampling error per billion board feet is indicated as 15.8 percent in the preceding tabulation.

Figure 2 shows the average sampling accuracy for volumes ranging from 70 million to 11 billion cubic feet, and from 70 million to 40 billion board feet.

Illustrative Examples of Estimating the Sampling Accuracy of Breakdowns of Timber Products Output:

Region	Species group	Timber products output, all products	Sampling error from figure 2
		(billion cu. ft.)	(percent)
Central	Softwood	0.017	25+
	Hardwood	.459	9.6
West Gulf	Softwood	.641	8.1
	Hardwood	.502	9.2
Pacific Northwest	Softwood	2.522	4.1
Southern Rocky Mtn.	Softwood	.122	10.9
	Hardwood	.014	25+
All of United States	Softwood	7.511	2.4
	Hardwood	3.576	3.4

For regions or States for which sampling errors by product group are given in the tabulation on page 5, use can be made of figure 1 in

estimating the sampling error of breakdowns. Thus, for the Middle Atlantic Region:

Region and volume breakdown	Sawlog volume	Proportion	Factor	Sampling error
	(billion cu. ft.)			(percent)
Middle Atlantic				
Softwood	0.082	.31	1.81	1/ 11.8
Hardwood	.179	.69	1.22	2/ 7.9
Total	.261	1.00	1.00	6.5

1/ 6.5 x 1.81
2/ 6.5 x 1.22

Parallel procedures are used for breakdowns of board-foot volume.

Timber Cut

Conversion of output volume to volume cut was based on estimates of origin of output and associated logging residues. This required the use of data from a variety of sources and utilization factors for which sampling errors could rarely be computed. The sampling accuracy standard was set at 12 percent per billion cubic feet of timber cut. Since the major factor in this estimate is timber products output and this is estimated to have a sampling reliability averaging 6.5 percent, it is safe to conclude that timber cut is well under the accuracy goal of 12 percent per billion cubic feet, and likely to be in the neighborhood of 8 to 9 percent.

Plant Residue Use

The plant residue study was the first of its kind ever undertaken on a broad scale. Since the study was chiefly concerned with accurate information on proportion of residue that was used, the sampling accuracy standard was set on this item. This standard was set at 10 percent of the percentage of plant residues used as determined for all industries combined in each region. This goal was met or exceeded in each region.

Productivity of Recently Cutover Lands

A nationwide field survey was made to appraise productivity on recently cut lands. This survey met the requirements of probability sampling so that sampling errors could be calculated for the major items of information.

Data for all private ownerships that had less than 5,000 acres in commercial forest were obtained by sampling. For private ownerships between 5,000 and 50,000 acres, sampling was employed in most States having 15 or more ownerships in this size range; coverage was 100

percent in all other States. Federal, State, county, municipal, and other local government ownerships were generally covered 100 percent. All private ownerships of 50,000 acres and larger were covered 100 percent, with the exceptions that sampling was employed in this size class in Florida and, in addition, there were seven ownerships in other States for which access for field examination was denied.

The basic sampling plan was designed to give commercial forest area statistics of adequate sampling reliability by regions. Sampling error goals were set for each region. These goals were met satisfactorily. For private ownerships of less than 5,000 acres, the nationwide goal for sampling accuracy was 2.0 percent for the estimate of commercial forest land. The sampling accuracy actually achieved was 1.9 percent.

In table 2 are listed by region and section the sampling errors applicable to estimates of privately-owned commercial forest land, number of ownerships, and area of types within ownerships in which recent cutting was done and breakdowns of this area by productivity class. Public ownerships are not included because coverage was generally 100 percent.

Figure 3 provides the method of approximating the sampling accuracy of further breakdowns of the items for which sampling errors are given in table 2. In general, sampling errors are larger percentage-wise for parts than for the whole, and become larger the finer the breakdown. A major purpose in calculating sampling errors is to determine the limit of breakdowns for which estimates may be considered reliable.

The application of figure 3 corresponds essentially to that previously used in applying figure 1. For a particular breakdown, find the smallest unit of which it is a part and for which the sampling error is given in table 2. Determine the proportion of number of ownerships or area which the breakdown represents, read the corresponding factor from figure 3. The product of this factor and the standard error of the whole is the approximate sampling error of the breakdown.

Figure 3, line (A) applies to statistics obtained by area sampling. This includes private ownerships of less than 5,000 acres in all regions except the Pacific Northwest, Northern Rocky Mountain, and Southern Rocky Mountain. With the exception of these three regions, in which list sampling was employed, factors applicable to determining the sampling accuracies of breakdown of small ownerships should be read from line (A).

Figure 3, line (B) applies to statistics obtained by list sampling. This includes all ownerships in the size range 5,000 to 50,000 acres and small ownerships in the Pacific Northwest, Northern Rocky Mountain, and Southern Rocky Mountain Regions. Line (B) will apply also in approximating the sampling accuracies of breakdowns of all ownerships of more than 5,000 acres.

Table 1.--Sampling accuracy 1/ of estimates of forest area, inventory volume, and net annual growth by section, region, and State

(United States and Coastal Alaska)

Region and State	Forest	Commercial forest land	Noncommercial forest land 2/	Inventory volume 2/		Net annual growth 2/	
				Board feet	Cubic feet	Board feet	Cubic feet
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
NORTH							
New England:							
Connecticut**	2.1	2.1	..	5.8	4.4	24.9	19.0
Maine***	1.4	1.4	14.5	3.7	2.8	21.4	16.3
Massachusetts**	1.7	1.7	..	4.7	3.6	22.9	17.5
New Hampshire*	1.0	.6	24.0	3.9	2.4	9.3	7.1
Rhode Island**	4.6	4.6	..	16.4	12.5	29.5	22.5
Vermont*	1.4	1.4	..	3.2	2.2	3.8	2.9
All States	.8	.8	11.5	2.3	1.6	10.0	7.5
Middle Atlantic:							
Delaware***	8.9	9.0	..	19.2	14.7	..	..
Maryland*	1.7	1.7	..	3.6	2.6	16.8	12.8
New Jersey***	4.3	4.3	..	13.5	10.3	..	..
New York*	1.3	.9	6.4	1.8	1.4	10.5	8.0
Pennsylvania**	.8	.8	31.5	2.0	1.5	11.0	8.4
West Virginia*	.7	.7	..	2.7	2.0	3.3	2.5
All States	.6	.5	6.1	1.2	.9	5.1	3.7
Lake States:							
Michigan**	1.0	1.0	14.6	3.1	2.4	28.6	21.8
Minnesota*	.7	.5	8.8	1.5	1.0	11.3	8.6
Wisconsin**	1.1	1.1	22.0	3.4	2.6	37.3	28.5
All States	.5	.5	7.1	1.8	1.3	16.7	12.2
Central States:							
Illinois*	1.7	1.6	..	3.7	2.8	17.4	13.3
Indiana*	1.3	1.2	..	2.4	1.8	10.9	8.3
Iowa***	3.8	3.8	..	12.0	9.2	..	..
Kentucky*	.9	.9	..	2.0	1.5	30.6	23.4
Missouri*	.7	.7	29.3	2.6	2.0	11.9	9.1
Ohio*	1.1	1.0	..	2.1	1.6	10.2	7.8
All States	.5	.5	17.0	1.2	.9	12.0	8.4
Plains:							
Kansas***	4.6	4.6	..	20.2	15.4	..	..
Nebraska***	4.9	4.9	..	29.9	22.8	..	..
North Dakota***	9.2	9.4	..	39.3	30.0	..	..
Oklahoma (West)***	4.6	7.4	5.2	21.0	16.0	..	..
South Dakota (East)***	7.4	7.2	32.5	25.5	19.5	..	..
Texas (West)***	2.0	7.8	2.0	..	..	..	..
All States	1.6	2.5	1.9	11.9	8.7	45.4	30.8
All regions	.4	.3	1.7	.8	.6	6.0	4.2
SOUTH							
South Atlantic:							
North Carolina**	1.1	1.1	13.8	2.1	1.7	9.2	7.0
South Carolina*	.7	.7	..	1.6	.8	4.6	3.5
Virginia**	1.3	1.3	13.7	3.8	2.8	15.4	11.8
All States	.7	.6	9.5	1.5	1.1	6.2	4.8
Southeast:							
Alabama*	.3	.3	..	2.1	1.5	7.7	5.9
Florida*	.6	.4	8.0	1.7	1.7	9.4	7.2
Georgia*	.3	.3	33.0	1.4	1.2	6.0	4.6
Mississippi*	.5	.5	..	2.6	2.1	10.1	7.7
Tennessee*	.6	.4	19.7	2.3	1.7	10.9	8.3
All States	.2	.2	7.1	.9	.7	3.7	3.0
West Gulf:							
Arkansas*	.4	.4	..	2.1	1.7	10.1	7.7
Louisiana**	1.1	1.1	32.8	2.9	2.2	11.8	9.0
Oklahoma (East)***	2.7	2.6	11.6	9.8	7.5	41.9	32.0
Texas (East)***	1.7	1.7	..	4.8	3.7	18.9	14.4
All States	.6	.6	10.5	1.8	1.4	7.6	5.8
All regions	.3	.3	5.0	.8	.6	3.3	2.5

Table 1.--Sampling accuracy 1/ of estimates of forest area, inventory volume, and net annual growth by section, region, and State - Continued

(United States and Coastal Alaska)

WEST

Region and State	Forest	Commercial forest land	Noncommercial forest land 2/	Inventory volume 2/ Board feet	Inventory volume 2/ Cubic feet	Net annual growth 2/ Board feet	Net annual growth 2/ Cubic feet
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Pacific Northwest:							
Oregon**	1.0	0.9	4.7	1.8	1.4	19.6	15.0
Washington*	1.2	1.0	4.6	2.0	1.5	20.3	15.5
All States	.8	.7	3.3	1.3	1.0	14.3	10.8
California*	1.2	.6	1.9	2.1	1.6	5.5	4.2
Northern Rocky Mountain:							
Idaho**	1.5	1.2	3.6	3.5	2.7	27.5	21.0
Montana*	1.2	.6	3.8	2.6	3.0	10.1	7.7
South Dakota (West)***	3.4	2.6	27.6	13.9	10.6	..	..
Wyoming***	2.7	3.2	3.7	9.7	7.4	..	..
All States	.9	.6	2.1	2.3	1.9	21.3	14.0
Southern Rocky Mountain:							
Arizona***	2.2	3.4	2.5	10.2	7.8	..	..
Colorado***	1.9	2.0	2.8	6.9	5.3	..	..
Nevada***	2.9	18.0	2.9	..	..	..	..
New Mexico***	1.9	2.5	2.9	10.2	7.8	..	..
Utah***	2.3	3.4	2.7	13.8	10.5	..	..
All States	1.0	1.3	1.2	4.8	3.6	40.4	30.2
All regions	.5	.4	.9	1.0	.8	8.7	6.6
All sections, United States	.2	.2	.8	.7	.5	3.1	2.2
Coastal Alaska***	4.9	8.2	6.0	11.0	8.4	..	..
United States and Coastal Alaska	.2	.2	.9	.8	.6	3.1	2.2

1/ Sampling error in terms of one standard error.
2/ Omitted entries indicated estimates are too crude for use on a State basis.
* Indicates Group I States. These States were converted by Forest Survey since January 1, 1947.
** Indicates Group II States. In these States Forest Survey field work was sufficiently advanced to furnish a data base for extension to the remainder of the State.

*** Indicates Group III States and Coastal Alaska, which do not fall in Groups I or II. In these States either special surveys were made or Forest Survey data taken prior to January 1, 1947 were adjusted to bring the statistics up to date. A special survey was made in Coastal Alaska, using probability sampling, which permitted calculation of the sampling accuracies shown.

Table 2.--Sampling accuracy[1/] of estimates of private commercial forest land, number of private ownerships, area of types with cutting, and area by productivity class, by size class of ownership, section, and region

(United States and Coastal Alaska)

SMALL OWNERSHIPS (LESS THAN 5,000 ACRES)

Section and region	Commercial forest land	Number of ownerships 2/	Area of types with cutting	Area of types with cutting on which productivity rates-- 3/ High	Medium	Low
	Percent	Percent	Percent	Percent	Percent	Percent
North:						
New England	3.5	4.9	8.0	12.6	13.5	20.0
Middle Atlantic	6.1	4.1	13.6	16.2	16.0	49.3
Lake States	5.3	3.3	10.6	13.6	17.5	19.3
Central States	4.3	6.8	11.1	14.0	15.6	27.8
Plains	15.9	15.0	37.7	..	..	37.8
All regions	2.6	2.8	6.0	7.8	8.2	17.4
South:						
South Atlantic	5.6	6.4	9.0	15.0	14.0	21.2
Southeast	3.5	4.3	5.3	12.9	12.6	11.6
West Gulf	7.8	5.6	11.8	20.7	12.0	15.6
All regions	3.0	3.1	4.6	8.9	7.7	8.6
West:						
Pacific Northwest	3.3	1.9	5.4	8.4	9.1	16.8
California	10.4	10.7	16.7	25.8	21.4	30.1
Northern Rocky Mountain	8.8	11.0	10.8	10.5	18.0	20.5
Southern Rocky Mountain	11.9	13.1	28.5	47.7	40.2	18.5
All regions	3.3	2.9	4.8	7.6	7.8	11.8
All sections, United States	1.9	2.0	3.4	5.5	5.1	7.4
Coastal Alaska	0	0	0	0	0	0
United States and Coastal Alaska	1.9	2.0	3.4	5.5	5.1	7.4
MEDIUM OWNERSHIPS (5,000 to 50,000 ACRES)						
North:						
New England	2.3	0	2.7	6.8	47.1	62.6
Middle Atlantic	2.3	0	6.0	15.0	18.2	47.9
Lake States	1.6	0	9.1	12.0	28.8	10.6
Central States	3.2	0	6.3	11.1	16.1	47.0
Plains	0	0	0	0	0	0
All regions	1.2	0	3.0	6.4	14.2	31.8
South:						
South Atlantic	3.7	0	7.1	8.7	33.8	0
Southeast	3.4	0	5.6	9.5	23.4	19.4
West Gulf	1.8	0	4.8	10.4	12.2	28.8
All regions	2.1	0	3.6	6.1	13.4	16.0
West:						
Pacific Northwest	4.9	0	6.6	12.2	27.0	63.2
California	5.6	0	8.2	12.6	49.9	0
Northern Rocky Mountain	0	0	0	0	0	0
Southern Rocky Mountain	17.9	0	0	0	0	0
All regions	3.5	0	4.4	8.1	19.2	30.3
All sections, United States	1.4	0	2.4	4.2	9.2	13.0
Coastal Alaska	0	0	0	0	0	0
United States and Coastal Alaska	1.4	0	2.4	4.2	9.2	13.0

Table 2.--Sampling accuracy[1/] of estimates of private commercial forest land, number of private ownerships, area of types with cutting, and area by productivity class, by size class of ownership, section, and region - Continued

(United States and Coastal Alaska)

MEDIUM AND LARGE OWNERSHIPS (5,000 ACRES AND LARGER)

Section and region	Commercial forest land	Number of ownerships 2/	Area of types with cutting	Area of types with cutting on which productivity rates--3/ High	Medium	Low
	Percent	Percent	Percent	Percent	Percent	Percent
North:						
New England	0.5	0	2.1	1.3	6.7	7.1
Middle Atlantic	1.4	0	6.4	7.6	10.4	33.3
Lake States	.5	0	2.7	2.5	11.1	8.9
Central States	2.4	0	6.9	8.4	11.4	22.3
Plains	0	0	0	0	0	0
All regions	.5	0	1.9	1.6	4.7	21.5
South:						
South Atlantic	1.7	0	4.0	3.8	21.1	..
Southeast	1.7	0	5.3	4.8	21.4	23.7
West Gulf	.6	0	2.6	2.5	5.5	12.9
All regions	.9	0	2.9	2.7	10.0	15.1
West:						
Pacific Northwest	1.5	0	3.2	2.8	17.0	42.0
California	2.8	0	6.4	6.4	24.4	0
Northern Rocky Mountain	0	0	0	0	0	0
Southern Rocky Mountain	7.3	0	0	0	0	0
All regions	1.2	0	2.1	2.2	5.9	16.3
All sections, United States	.6	0	1.9	1.9	5.0	11.7
Coastal Alaska	0	0	0	0	0	0
United States and Coastal Alaska	.6	0	1.9	1.9	5.0	11.7

ALL PRIVATE OWNERSHIPS

Section and region	Commercial forest land	Number of ownerships 2/	Area of types with cutting	High	Medium	Low
North:						
New England	2.1	0	2.9	2.4	6.6	18.1
Middle Atlantic	5.2	0	8.4	10.3	10.5	37.1
Lake States	4.5	0	6.0	7.2	13.2	17.3
Central States	4.1	0	8.7	12.2	13.7	26.2
Plains	15.9	0	43.1	..	..	38.0
All regions	2.1	0	3.2	3.9	5.2	14.7
South:						
South Atlantic	4.7	0	6.3	7.8	12.6	19.5
Southeast	2.5	0	4.6	5.6	10.6	10.4
West Gulf	5.1	0	4.4	5.3	7.7	12.5
All regions	2.2	0	3.0	3.7	6.2	7.7
West:						
Pacific Northwest	1.8	0	2.9	2.9	8.1	17.4
California	4.2	0	6.2	6.7	16.9	30.0
Northern Rocky Mountain	5.3	0	3.6	2.3	6.7	10.2
Southern Rocky Mountain	7.4	0	9.8	13.5	18.7	4.7
All regions	1.8	0	2.2	2.5	5.1	9.7
All sections, United States	1.4	0	2.0	2.7	3.6	5.9
Coastal Alaska	0	0	0	0	0	0
United States and Coastal Alaska	1.4	0	2.0	2.7	3.6	5.9

1/ Sampling error in terms of one standard error.

2/ No sampling error for ownerships of 5,000 acres and more because complete ownership lists were available and therefore sampling error was nil.

3/ Omitted entries indicate estimates too crude for use on a State basis. Large sampling errors frequently apply to a small area or percentage in the productivity class. Sampling error of 40 percent applicable to 5 percent of operating area indicated in low productivity, for example, indicates range of $\pm$ (5 x .40) = $\pm$ 2. The odds are 2 to 1 that the true percentage in the class would therefore fall in the range 3 to 7 percent.

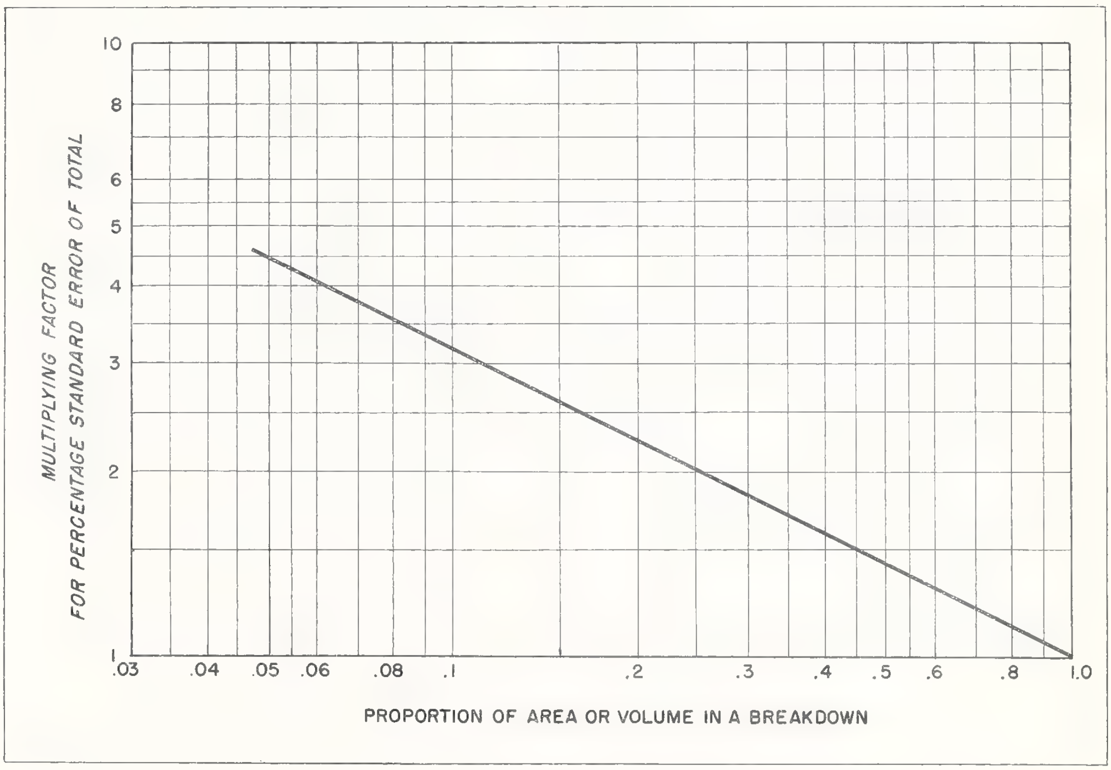

Fig. 1 - Ratio of standard error of an area or volume breakdown to percentage standard error of estimate of total area or volume

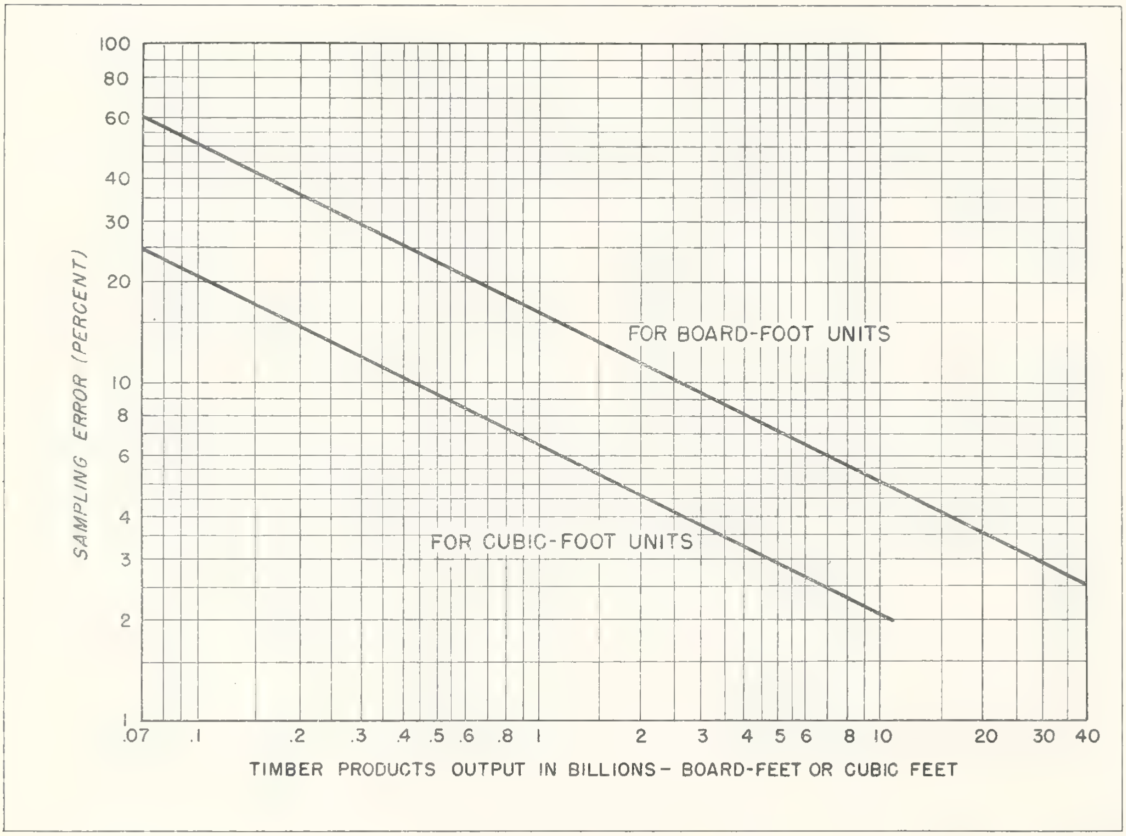

Fig. 2 -Sampling error of timber products output in percent

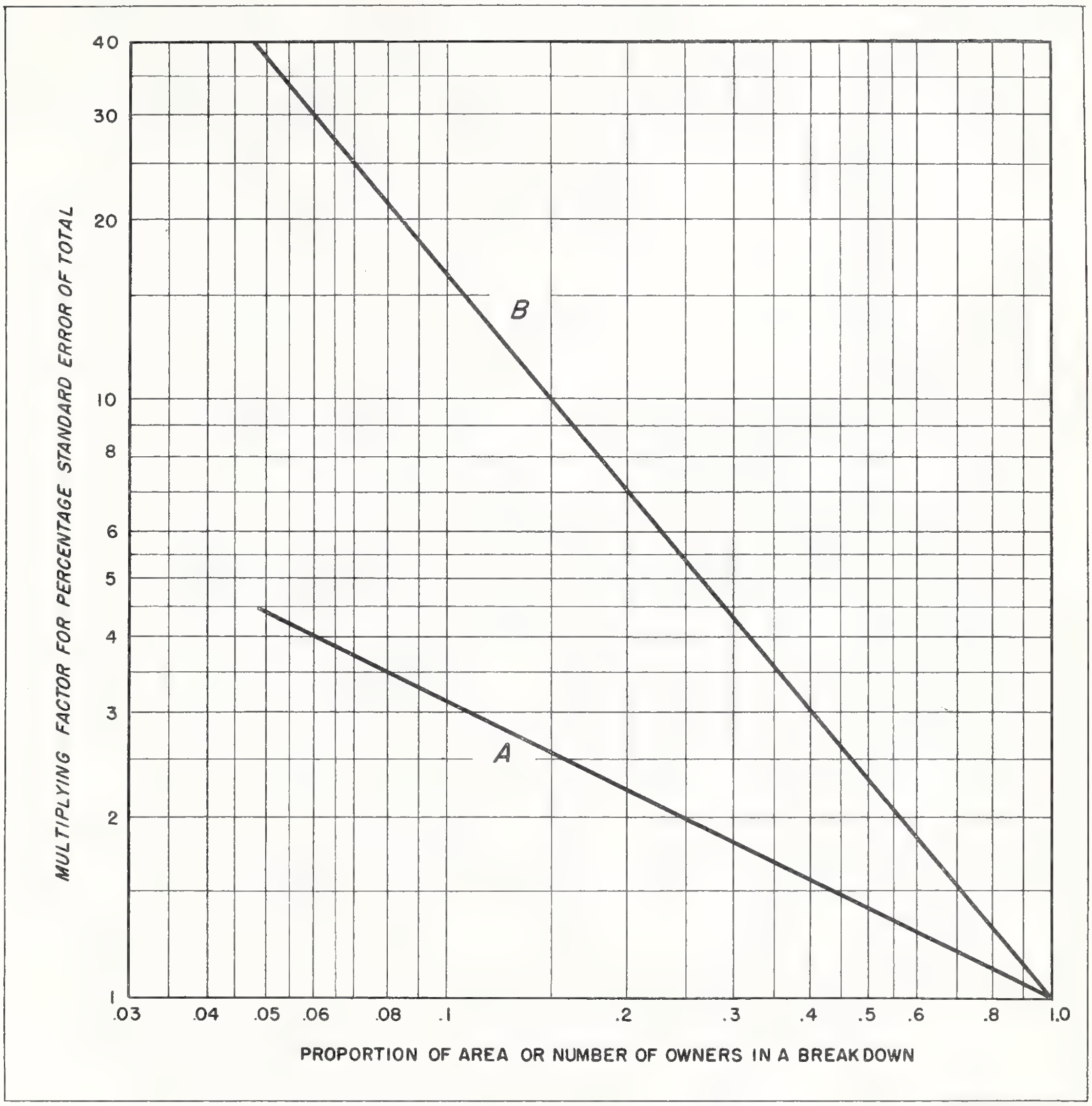

Fig. 3 - Ratio of standard error of an area or number-of-owner breakdown to percentage standard error of a total based on the survey of productivity of recent cutovers.

(A) Applies to area and number-of-owner statistics for ownerships of less than 5,000 acres in California and regions in North and South sections.

(B) Applies to area statistics of ownerships less than 5,000 acres in Pacific Northwest, Northern Rocky Mountain and Southern Rocky Mountain Regions. Applies also to area statistics for ownerships of 5,000 to 50,000 acres.

Regions and Sections used in the Timber Resource Review

TIMBER RESOURCE REVIEW

CHAPTER IX

APPENDICES

E. CRITERIA FOR RATING PRODUCTIVITY OF RECENTLY CUTOVER LANDS

(Preliminary Review Draft Subject To Revision)

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INDEX TO TIMBER RESOURCE REVIEW REPORTS AND APPENDIX MATERIAL

(Each Chapter and each Section, in the case of Chapters IV and IX, is a separate document)

CHAPTER IX. A P P E N D I C E S

E. CRITERIA FOR RATING PRODUCTIVITY OF RECENTLY CUTOVER LANDS

(Preliminary review draft subject to revision)

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September, 1955

Contents

CRITERIA FOR RATING PRODUCTIVITY ON RECENTLY CUTOVER LANDS

INTRODUCTION

This presentation of criteria is limited to a description of detailed procedures used in the field on an individual property and to summarization of standards and definitions. The principles and concepts basic to the criteria are discussed in the section "Condition of Recently Cutover Lands," Chapter IV. Methods followed in developing the criteria are discussed there too. The reader will find in that discussion the reasons for procedural steps and the concepts basic to the standards presented in the following pages.

In making the field ratings of productivity on recently cutover lands, existing stocking, the prospects for future stocking, species composition, and the felling age practiced thereon were measured and recorded in terms of specific criteria or guides. Because regional foresters of the Forest Service were assigned responsibility for conducting the surveys of recently cut lands, detailed criteria and field manuals for their application were prepared for each of the administrative regions of the Forest Service under the process already outlined in the section dealing with condition of cutover lands. To avoid repetition of definitions and procedures common to several regions or types, and to reduce space devoted to tabular presentations, these criteria have been summarized and condensed for type groups within the several Timber Resource Review regions or combinations of them. Voluminous material on the mechanics of procedure, such as the coding system used to record field data and the sampling procedures followed, has been omitted in this summary. Some of the minor guides, important locally, have also been omitted.

The subject matter under consideration is technical and highly complex. The technical reader interested in the procedures and standards for a given forest type in a particular locality should secure a copy of the field manual from the appropriate regional forester and also a copy from the Chief Forester of the basic plan entitled "Task VIII, Productivity of Recently Cut Lands - July 1953."

The major purpose of the following pages is to preserve and to make public the major standards used in determining productivity of cutover areas during the 1953 survey.

DEFINITION AND EXPLANATION OF TERMS

Some definitions and explanations were applied in all regions and in all forest type groups. These are summarized below. Important exceptions and additions to meet local conditions appear in the criteria for the regions and type groups in which they occur.

Crop Tree

Only crop trees were counted in the field sampling made to estimate stocking. For Timber Resource Review purposes crop trees were defined as trees of desirable or acceptable species as specified in the

individual type group descriptions and which by local experience have proved their ability to produce commercial wood products on the site under examination and, if below commercial size, show capability of growth to merchantability by reason of their form, vigor, crown position, and freedom from injury, disease, and parasites. Only mature specimens or those capable of making good growth at the time of examination qualified as crop trees. Ability of a young tree to survive a period of suppression and eventually develop into a crop tree did not qualify such a tree to be counted as contributing to stocking.

Effect of Felling Age

Effect of felling age is the reduction of productivity which results from clear cutting or very heavy cutting in stands before the culmination of mean annual growth for the class of products removed. It is expressed as that percentage of the mean annual growth at culmination reached by the stand at the age when clear cut. Thus, if a given species culminates mean annual growth at 120 years with a mean annual growth of 200 volume units, but was cut at 80 years when mean annual growth was 150 units, allowance for this effect of felling age reduced the productivity rating by 25 percent. Effects of felling age were recognized for two general classes of products depending upon plurality of the volume cut: (a) large products and high quality products such as saw and veneer logs, and (b) small, relatively lower quality products such as cordwood. Products that did not fit this classification, such as Christmas trees, corral poles, fencing material, and transmission poles, were assumed to have reached maturity at the age cut, and for such products no felling age effect was considered. Also, no reduction for felling age was made either for stands or individual trees whose removal did not have a material effect in reducing growth. Examples: (a) injured and diseased trees or stands, (b) trees in the suppressed crown classes, and (c) trees or overstory stands impeding understories having potentially higher value.

Seed Trees

Seed trees were required to have a full, healthy crown, and reasonable prospects of surviving for a sufficient time to bear at least one full crop of seed.

Forest Types

The forest type group classification followed in the preparation of criteria is that described in the Appendix Definition of Terms, and is the same as that used by the nationwide Forest Survey. Specific types and sub-types recognized in the regional criteria were keyed to the Forest Survey type group classification. Basis for type classification was the species composition just prior to the most recent cutting.

Species Classification

For each forest type recognized in the regional criteria the principal tree species encountered are listed as "desirable," "acceptable," or

"noncount," depending on their rate of growth, susceptibility to injury and parasites, and the utility of their products in comparison to that of associated species. Classification of minor species of relatively little importance not listed in the criteria was determined by the field examiners as encountered.

Established Seedlings

Healthy seedlings of desirable or acceptable species which have completed one growing season, and which meet crop tree specifications, are designated as "established," unless specified otherwise in the individual criteria.

Clear Cuttings

Clear cuttings are defined as cuttings which remove all the trees or all or substantially all of the trees which are merchantable for the products being harvested, and that result in elimination of most of the original overstory. In the East, when 80 percent or more of the merchantable volume of the specific product was removed, the area was considered clear cut.

In the eastern part of the country including North Dakota, Oklahoma, and Texas, the productivity classification of recently cutover lands was derived from numerical ratings based on tallies of sample plots distributed throughout the cutover areas.

The existing stocking was tallied on concentric circular plots, a 1/100-acre plot being used for trees up to the 6-inch d.b.h. class, and 1/5-acre plots used for trees in the 6-inch d.b.h. class and larger. The "desirable" and "acceptable" species were recorded by these two categories, and ratings of existing stocking were read from cumulative stocking tables prepared from the standards for the type.

If this step showed that less than one-half of the existing stocking consisted of desirable species, the rating was reduced by applying a composition factor calculated separately. A minimum of 0.5 was adopted for this composition factor so that no rating of existing stocking could be reduced by more than this amount.

If the plot was not fully stocked, prospective stocking was calculated by various methods based on the standards for the particular forest type. Generally, the prospective stocking rating was based on: (1) the available seed source--either from seed trees on the cutover area and/or from an adjacent uncut stand which contained seed-bearing trees, and (2) the condition of the seedbed, existence of slash, cull trees, weed trees, or herbaceous growth on the plot which would inhibit establishment or growth of trees. The effects of grazing, rodents, deer browsing, etc., were included in arriving at the final numerical estimate for prospective stocking.

Figures for existing stocking and prospective stocking were added to obtain a value for total stocking. The maximum value recorded for stocking was 100 percent. If the stand was cut heavily, i.e., more than 80 percent of the volume in merchantable sizes for the products harvested was removed, and the trees were cut at ages younger than the age of culmination of mean annual growth for the class of product harvested, the rating was reduced by applying a felling age factor. In even-aged stands, average age was used as the felling age to ascertain the factor. In uneven-aged stands, a weighted average factor was calculated. The final productivity estimate was the product of stocking percentage, the composition factor, and the felling age factor.

Data and calculations for productivity ratings were recorded on a field work sheet, a sample of which is shown below. A productivity estimate was calculated on this sheet for each plot. The estimate for a given forest type on an ownership was the average of all plots taken in the cutover part of the type on the ownership.

FIELD WORK SHEET

Owner (Name) John Doe (Number) Forest Type L.-SL Pine
Plot Number 1

EXISTING STOCKING

Size Class	Desirable No.	Desirable Stocking %	Acceptable No.	Acceptable Stocking %
Repro.				
2			..	25
4	.	17	..	
6	...	4		
8			..	4
10				
12			.	4
14				
16				
18				
20				
22				
24				
Totals		21		33

Total Existing Stocking 54 % (A)
Prospective Stocking 19 %
Total Stocking 73 % (B)

.29) .2734 = 94
261
124
116
8

.27) .2100 = 78
189
210
216

.78 × .54
312
390
.4212

.94 × .61
94
564
.5734

PROSPECTIVE STOCKING OF DESIRABLE SPECIES

Seed Trees Per Acre DBH.	No.	Stock-ing %	Other Seed Sources Dist. Chs.	Stock-ing %	Total Prosp. Stock.% (1)	% of Plot Area Pot. Stockable (2)	Final Prosp. Stock.% (1)x(2)
6							
8							
10	.	6					
12	.	8					
14	..	20					
16+							
Total		34	6	30	64	30	19

EFFECT OF FELLING AGE OR SIZE

Even Aged Stands Age Count On Stumps	Uneven-Aged Stands Sp.	Stump dib.	Age	No.	Stock-ing Factor (1)	Felling Factor (2)	(1)x(2) (3)
	L.P.	12	40	.	4	1.00	4.00
	S.P.	10	35	.	3	.98	2.94
	"	10	30	.	3	.94	2.82
	"	8	30	..	4	.94	3.76
	"	6	25	...	4	.82	3.28
	"	6	30	.	1	.94	.94
	L.P.	8	25	..	4	.90	3.60
	S.P.	12	50	.	4	1.00	4.00
	NON GROWING STOCK (DEFECTIVE, ETC.)						
		6		..	2	1.00	2.00
Total				Total	29		27.34

Ave. Factor

Weighted Factor = $\frac{(3)}{(1)} = \frac{27.34}{29} = .94$

Adjustment for Composition:

Composition Factor = $\frac{\text{Stocking \% of Desirable Species}}{\text{Total Existing Stocking \% x 0.5}} = \frac{21}{54 \times 0.5} = \frac{21}{27} = .78$

Stocking Modification for Composition = Factor x Total Existing Stocking

= .78 x 54 = 42

Add Prospective Stocking 19

Total Adjusted Stocking 61 (C)

Final Rating = Adjusted Stocking x Felling Factor: 61 x .94 = 57 (D)

Entries at (A), (B), (C), and (D) will be recorded on field form.

To illustrate the field procedure, a sample calculation for one plot record is presented here and shown on a sample form on the field work sheet used.

Sample Calculation

State - Virginia (Criteria for the South Atlantic TRR Region used).
Forest type - Loblolly-shortleaf pine, cut for pulpwood 1 year before the examination.

Existing Stocking (see upper left block of field tally sheet)

The following crop trees were recorded on the 1/100-acre plot:
Desirable species - 1 tree 4 inches d.b.h.
Acceptable species - 2 trees 2 inches d.b.h.

The following trees were recorded on the concentric 1/5-acre plot:
Desirable species - 3 trees 6 inches d.b.h.
Acceptable species - 2 trees 8 inches d.b.h.
1 tree 12 inches d.b.h.

These trees were tallied in the column headed "No." in the respective desirability columns. The stocking percentage was taken from the cumulative stocking table (table 1) prepared for field use from the basic standards shown in table 17.

Similar cumulative tables were prepared for all types and in some cases by sites (Central States hardwoods) based on the standards of number of trees of various sizes needed to rate 100 percent stocking.

The stocking percentages were then totaled (see field work sheet). Results: 21 percent for "desirable" species and 33 percent for "acceptable" species. The total existing stocking estimate was thus 54 percent. In other words, 54 percent of the area was estimated to be occupied by crop trees of "desirable" and "acceptable" species.

Existing Stocking Modified by Composition

Since less than 50 percent of existing stocking was composed of "desirable" species, an adjustment was made by use of a composition factor, calculated by the following formula:

$$\text{Composition factor} = \frac{\text{existing desirable stocking \%}}{.5 \times \text{existing total stocking \%}}$$

Example:

$$\text{C.F.} = \frac{21}{.5 \times 54}$$

$$\text{C.F.} = \frac{21}{27} = .78$$

Therefore, the estimate for existing stocking was reduced by applying the factor 0.78. The adjusted estimate for existing stocking was then 78% x 54% = 42%.

Table 1.--Crop tree stocking standards for the Southern section, by diameter class

Diameter breast high (inches)	Number of trees on plot: 1	2	3	4	5	6	7	8	9	10	20	Number trees per acre for 100 percent stocking
	Cumulative stocking percent											
	1/100-acre plot - Radius 11.8 ft.											
Reproduction	10	20	30	40	50	60	70	80	90	100	..	1,000
2	12	25	38	50	62	75	88	100	..	..	..	800
4	17	34	51	68	85	100	..	..	..	..	..	590
	1/5-acre plot - Radius 52.7 ft.											
6	1	2	4	5	6	7	9	10	11	12	25	400
8	2	4	6	8	10	12	15	17	19	21	42	240
10	3	6	10	13	16	19	23	26	29	32	65	155
12	4	9	13	17	22	26	30	35	39	44	87	115
14	6	11	17	22	28	33	39	44	50	56	..	90
16	7	14	21	28	35	42	49	56	62	69	..	72
18	8	17	25	33	42	50	58	67	75	83	..	60
20	10	20	29	39	49	59	69	78	88	98	..	51
22	12	24	36	48	60	71	83	95	100	..	..	42
24	14	28	42	56	69	83	97	100	..	..	..	36
26	16	32	48	65	81	97	100	..	..	..	..	31
28	19	37	56	74	93	100	..	..	..	..	..	27
30	21	42	62	83	100	..	..	..	..	..	..	24
32	24	48	71	95	..	..	..	..	..	..	..	21
34	26	53	79	100	..	..	..	..	..	..	..	19
36	29	59	88	..	..	..	..	..	..	..	..	17
38	33	67	100	..	..	..	..	..	..	..	..	15

Prospective Stocking

Since the area was not fully stocked, the prospects of future stocking were considered. The following pine seed trees were observed on a concentric 1-acre plot:

1 seed tree 10 inches d.b.h.
1 seed tree 12 inches d.b.h.
2 seed trees 14 inches d.b.h.

These were tallied under "Seed Trees per Acre" on the field work sheet, and the corresponding prospective stocking percentages shown in table 2 were recorded. This table was derived from the basic standards presented on page 43.

The sum of the ratings for the various seed trees was 34 percent. In other words, the seed trees remaining were estimated to be capable of producing seed enough to restock the plot to 34 percent of full stocking. Other seed sources were considered, such as seed from adjoining uncut stands of seed-bearing trees. The center of this plot was 6 chains from a seed wall of uncut pines. This was recorded under "Other Seed Sources (Distance in Chains)." The corresponding prospective stocking (30 percent) was taken from the appropriate seed source standard (page 43) which indicated that 30 percent stocking will result, on the average, from seed dispersed from a source $5\frac{1}{2}$ to $6\frac{1}{2}$ chains distant.

Therefore, sufficient seed was expected to fall on this 1/5-acre plot to restock the unstocked portion of the area 64 percent of full stocking: Seeds from seed trees, 34 percent + seeds from seed wall, 30 percent = 64 percent. This sum was recorded under the column heading, "Total Prospective Stocking (Percent)."

At this point the field examiner estimated the percentage of the 1/5-acre plot that was capable of being restocked by this seed source. In this example, 54 percent of the area was occupied by existing stocking, which left 46 percent unstocked. If there were cull trees, brush, or other adverse conditions occupying a portion of the unstocked area, the portion so occupied was deducted to arrive at the proportion of the plot area estimated to be capable of restocking. Grazing damage and other factors were considered in arriving at the entry made here. In this case, for example, it was determined that cull trees, brush, etc., occupied 16 percent of the plot area which was not stocked, leaving only 30 percent of this area available for future stocking. The final prospective stocking estimate then was computed as the product of the "Total Prospective Stocking (Percent)" and the "Proportion of Plot Area Restockable," or 64 x .30 = 19 percent. This added to the total existing stocking (54 + 19) = 73 percent. The final prospective stocking percentage added to the percentage of adjusted existing stocking gives a total adjusted stocking rating of 61 percent, i.e., 19 + 42 = 61.

Table 2.--Prospective stocking of loblolly-shortleaf pine in the Southern section, by seed-tree size class and number of trees per acre.

Diameter breast high (inches)	Number of seed trees per acre															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Prospective stocking in percent															
10	6	13	20	89	30	37	45	51	59	65	71	77	84	90	97	100
12	8	16	24	32	40	48	56	64	72	80	88	96	100			
14	10	20	30	40	50	60	70	80	90	100						
16	13	27	40	53	67	80	93	100								
18+	22	44	67	89	100											

Therefore, if the timber was not cut prematurely, or if the cutting was only a partial cut, the productivity rating of the area would be 61 percent. However, if the area were cut heavily (as was the case in this example), the effect of felling age is considered as a factor affecting the rating.

Felling Age Effects

The example assumes an uneven-aged stand, requiring calculation of a weighted rating. The stumps were recorded on the field work sheet by species. In this example the following stumps were recorded on the plot:

Species	Diameter inside bark (inches)	Age (years)
1 loblolly pine	12	40
1 shortleaf pine	10	35
do.	10	30
2 shortleaf pine	8	30
3 shortleaf pine	6	25
1 shortleaf pine	6	30
2 loblolly pine	8	25
1 shortleaf pine	12	50
2 nongrowing stock . . .	6	..

The two nongrowing stock trees appeared to have been severely suppressed or defective, as shown by examination of the stumps and tops left in the woods.

The stocking factors for the various number and sizes of trees cut were recorded from the existing stocking table (table 1). D.i.b. on stump was considered to be d.b.h. for this purpose.

The felling factors for the various ages and species were read from the standards showing the proportion of peak mean annual increment which is reached at various ages by different species cut for cordwood (table 18, columns 3 and 5). These were recorded in the column headed "Felling Factor." The products of the stocking percentages and the corresponding felling age factors were computed, and these products totaled. (The felling age factor for the nongrowing stock trees is always 1.00.) The total of these products was 27.34. The total stocking percentage for the stumps tallied was 29. Therefore, the weighted felling age factor is $\frac{27.34}{29} = .94$.

Final Productivity Rating

The estimated total adjusted stocking percentage is multiplied by the felling age factor to obtain the estimated productivity rating for the plot. The final rating for the plot used as an illustrative example is the product (61 x .94 = 57 percent).

The preceding example was chosen to include all possible calculations. Quite often the calculation of a composition factor was unnecessary because 50 percent or more of the existing stocking was composed of "desirable" species. Also, no felling age factor was calculated when stands were partially cut, i.e., when less than 80 percent of the volume of operable sizes was removed. Often the calculations required to obtain a weighted felling factor for uneven-aged stands were not needed due to the even-aged character of the stand cut.

In the West, including South Dakota, Nebraska, and Kansas, stocking, composition, and the effects of felling age were measured by the point sampling method. Applied to stocking, this method is based on the concept that when a number of sample points are classified according to presence or absence of stocking at each point, the percent of total points classed as stocked is an estimate of the percentage of the area stocked. In using the system, methods were prescribed to provide location of sample points without bias and distribution of them over the entire area being sampled.

Existing Stocking

The examiner first determined for each observation point whether or not the growing space represented by that point was stocked with a crop tree. Decision was based on stocking tables showing the maximum radii within which trees of various sizes must occur to classify the point as stocked. Where two or more trees occurred within prescribed radii, the closest tree to the point having an equal or better chance of survival than its competitors was used to determine the stocking. As shown in the regional stocking tables, for example table 20, the area stocked is directly related to tree size, i.e., the larger the tree the greater the area stocked by it.

The species of crop tree stocking the point was recorded on the field work sheet as either "D" or "A" (for desirable or acceptable respectively) in accordance with species listings for each type or type group. Certain species were considered as noncount in the type criteria. Where noncount species only occurred within prescribed radii, the point was classed as nonstocked.

Prospective Stocking

When a sample point was not stocked with an existing crop tree, the examiner then determined whether or not the chances for future stocking were favorable. The decision was based on guides for each forest type or type group. Such guides recognized distance to acceptable seed source, competing undesirable vegetation, and other measurable factors affecting reproduction. The point was classified as prospectively stocked if it met the standards given in the guides; otherwise it was classed as nonstocked.

After all the points in a timber type within a cutting area had been classed as stocked or nonstocked, the total number stocked (including both existing and prospective) was expressed as a percent of the total number of points examined.

Points falling on roads and skidways to be used again before a new tree crop reaches usable size were reported as unstocked.

Effect of Composition[1]

In order to measure the effect of species composition, species which stocked or showed potentials for stocking the points were classified as desirable or acceptable according to individual type criteria. For each type a standard of at least 50 percent of the points stocked with desirable species was established. The ratio of points stocked with desirable species to all stocked points was calculated. This ratio was then compared with the 50 percent standard. If the ratio obtained was equal to or greater than the standard, no adjustment was made. Otherwise the ratio obtained was divided by the standard and the resultant quotient obtained was used as the adjustment factor. If the adjustment factor obtained was less than 50 percent, the factor 50 was used.

Recording Effects of Felling Age[1]

The following procedure was used on cutover areas or portions thereof which had been clear cut. It was not used on partially cut areas. At each point the species of tree stocking the point prior to cutting was identified and its age or age class was determined by inspection of annual rings on the stump. The felling age factor was then read from tables in the appropriate type criteria, and this factor was recorded as a part of the record for the point.

Sample Calculation

Table 3 and the subsequent computations are examples of the type of field data taken and the calculations applied.

1/ The calculations referred to here were completed in the field by each examiner except for a part of the data collected in the States of California, Oregon, and Washington. Calculations from basic data collected in these three States were completed in the Washington Office of the Forest Service. Additional supplementary data were taken in these three States, the results of which are presented in Chapter IV of this report.

Table 3.--Calculation of productivity rating by the point method of field examination

Point	Stocking by species desirability		Record of felling age factors
	Existing	Prospective	
1	A	..	1.0
2	..	A	1.0
3	..	..	.5
4	..	..	.5
5	D	..	.5
6	A	..	1.0
7	A	..	1.0
8	..	..	1.0
9	..	D	1.0
10	..	..	.7
11	..	..	.7
12	D	..	.7
13	A	..	.7
14	A	..	1.0
15	..	D	1.0
16	..	A	1.0
17	D	..	1.0
18	D	..	1.0
19	..	..	1.0
20	..	A	1.0

A = acceptable species D = desirable species

Example:

Points stocked	D = 4	+	2	=	6	17.3
	A = 5	+	3	=	8	
					14	

Existing stocking: 9 ÷ 20 = 45 percent

Existing + prospective stocking: 14 ÷ 20 = 70 percent

Existing + prospective stocking modified by composition:

Factor $\frac{6}{14 \times .5}$ = .86 .86 x 70 = 60 percent

Felling age factor = 17.3 ÷ 20 = 86 percent

Combined rating = 60 x .86 = 52 percent

GENERAL STANDARDS OF CLASSIFICATION APPLICABLE TO ALL REGIONS

1. Species not listed in the standards as "desirable" or "acceptable" were considered "noncount" species for the purpose of existing stocking ratings. An exception was made for the occasional situation where an unlisted species was found to be locally useful for a special product. Field examiners were instructed to exercise their judgment in classifying such a species as "desirable" or "acceptable" in the locality.

2. Species composition of the stand did not affect the rating for existing stocking unless less than 50 percent of the existing stocking was composed of desirable species.

3. No composition factor less than 50 percent was used. Lower factors were raised to 50 percent.

4. In rating prospective stocking, consideration was given not only to the available seed supply, but also to such conditions as the presence of cull trees, weed species, sod or other herbaceous plant growth which would preclude the establishment or growth of trees. The effects of grazing, rodents, deer browsing, etc., were also considered if there was evidence to warrant inclusion of these factors in the rating.

5. Any points or plots or portions thereof dominated by a tree or trees not qualifying under the definition of crop tree were considered nonstocked regardless of other trees present or prospects for regeneration, unless acceptable plans by the owner to remove such trees in subsequent work were in evidence. The acceptance of such plans was determined by past performance or financial provision made to carry them out.

6. In the event that planned slash disposal, reforestation or timber stand improvement was incomplete on an area chosen to be sampled, the next most recent cutting in the ownership on which such treatment had been completed was examined.

If this substitution was not possible, due allowance was made for the effects of such anticipated treatment if the examiner was satisfied that such plans would be carried out promptly. Consideration was given to the success of past similar work, the relation of the area treated annually to the area cut over annually, outstanding orders or contracts to accomplish the work, and similar tangible evidence, bearing on productivity which may result from such operations. If none of these measures were practiced on the ownership or if the examiner considered such action to be problematical, the area was rated on the basis of conditions at the time of examination.

Forest Type Groups

The following forest type groups were recognized in these regions:

Spruce-fir
White-red-jack pine
Maple-beech-birch
Oak-hickory (including yellow-poplar and bottomland species)
Loblolly-shortleaf pine (including pitch, Virginia, and other yellow pines)
Oak-pine

Species Classification

The classification of species for the various forest types is listed in table 4.

Existing Stocking

The standards for rating existing stocking for the various forest types are shown in table 5.

Table 4.--Classification of species according to forest type, New England and Middle Atlantic Regions

Species	Spruce-fir type	White-red-jack pine type	Maple-beech-birch type	Oak-hickory type	Loblolly-shortleaf pine type	Oak-pine type
Ash sp.	D1/	D	D	D2/	..	D
Aspen, bigtooth	A3/	A4/	A5/	..	..	..
Aspen, quaking	A6/	A7/	A8/	..	..	..
Baldcypress	..	..	..	A	..	D
Basswood	..	D9/	D	D	..	..
Beech	A	A	A	A	..	..
Birch, paper	D10/	D11/	D	..	..	..
Birch, sweet	A	A	A12/	A	..	..
Birch, yellow	D	A	D	..	..	..
Blackgum	..	..	..	A	..	A
Butternut	..	..	..	A	..	..
Cherry, black	A	A13/	D	D14/	..	..
Cucumbertree	..	..	D	D	..	..
Elm	..	..	A	A	..	..
Fir, balsam	D	A15/	A	..	..	..
Hemlock	D	D	D	D	..	..
Hickory sp.	..	A	A16/	A	..	A
Locust, black	..	..	D16/	A	..	..
Maple, red	A17/	A	A18/	A	A	A
Maple, sugar	D	D	D	D	..	..
Oak, black	..	D	..	D19/	..	D
Oak, chestnut	..	A	..	D19/	A	A
Oak, pin	..	..	..	A	..	A
Oak, post	..	..	..	A	...	..
Oak, red (north. & south.)	..	D	D	D	D	D
Oak, scarlet	..	A	..	A	..	A
Oak, shingle	..	..	..	..	..	A
Oak, white (north. & south.)	..	D19/	A20/	D	D19/	D
Pine, loblolly	..	..	..	..	D	D
Pine, pitch	..	A	..	A	D	D
Pine, pond	..	..	..	..	D	..
Pine, shortleaf	..	..	..	D	D	D
Pine, red	D	D21/	D	..	D	..
Pine, Virginia	..	..	..	A	D	D
Pine, white	D	D	D	D	D	D
Redcedar	..	D22/	..	A	..	D
Spruce	D	D	D	..	..	..
Sweetgum	..	..	..	D	A	D
Sycamore	..	..	..	A	..	..
Tamarack	D19/	..	..	..	..	..
Walnut, black	..	..	..	D	..	..
White-cedar	D5/	..	..	A	..	..
Yellow-poplar	..	D	D	D	D	D

D = desirable species   A = acceptable species

1/ Brown ash is listed as acceptable in New Hampshire.
2/ Listed as acceptable in Pennsylvania.
3/ Listed as noncount in all States except Maine and New Hampshire.
4/ Listed as noncount in all States except Maine and western Massachusetts.
5/ Listed as noncount in all States except Maine, New Hampshire, Massachusetts, Pennsylvania, and northeastern New York (State District Nos. 9 and 10).
6/ Listed as noncount in all States except New Hampshire.
7/ Listed as noncount in all States except in the extreme northeastern part of New York (State District No. 9) and in western Massachusetts.
8/ Listed as noncount in all States except Massachusetts, Pennsylvania, New Hampshire, and northeastern New York (State District Nos. 9 and 10).
9/ Listed as acceptable in Maine, Massachusetts, and western half of New York (State District Nos. 2, 3, 4, 5, 6, 7, 8).
10/ Listed as acceptable in Connecticut.
11/ Listed as acceptable in Connecticut and all of New York except the northeastern part (State District Nos. 9 and 10).
12/ Listed as desirable in New Hampshire.
13/ Listed as noncount in northeastern New York (State District Nos. 9, 10, and 11), east of Connecticut River in Massachusetts and listed as desirable in Pennsylvania.
14/ Listed as acceptable in Pennsylvania and West Virginia.
15/ Listed as desirable in northeastern New York (State District Nos. 9 and 10).
16/ Listed as noncount in all States except West Virginia.
17/ Listed as desirable in West Virginia.
18/ Listed as desirable in swamps of Connecticut and north of Kanawha River in West Virginia.
19/ Listed as acceptable in New Hampshire.
20/ Listed as desirable in Connecticut and in southwestern New York (State District Nos. 2, 3, 4, and 5).
21/ Listed as acceptable in eastern and southern Connecticut.
22/ Listed as noncount in all States except Connecticut.

Table 5.--Trees required per acre for full stocking, by tree size and by forest type[1], New England and Middle Atlantic Regions

Diameter breast high (inches)	Spruce-fir	White pine	Maple-beech-birch	Oak-hickory, oak-pine, loblolly-shortleaf pine
	Number	Number	Number	Number
Reproduction	1,000	1,000	1,000	1,000
2	800	800	800	800
4	600	600	600	600
6	560	560	460	400
8	330	330	250	240
10	210	210	175	155
12	150	150	110	115
14	120	115	90	90
16	100	85	70	72
18	80	70	60	60
20	..	55	50	51
22	..	46	40	42
24	..	40	36	36

1/ For convenience in field application, stocking standards for these and all other eastern types were reconstructed in the form illustrated by table 1.

Prospective Stocking

Seed source standards for coniferous species are as follows:

Pines required per acre to rate 100 percent for seed-tree requirements[1]

	White pine type, light soils (number)	Loblolly-shortleaf-pine and oak-pine types (number)
D.b.h. (inches)		
6	..	30
8	..	20
10	15	17
12	12	13
14	9	10
16+	6	7

1/ For convenience in field application, seed tree standards for these and all other eastern types where applicable were reconstructed in the form illustrated in table 2.

Standards for determining prospective stocking, based on proximity to seed source

	Distance from seed source (chains)	Stocking expected (percent)
Timber type:		
Spruce-fir	0 - 5	100
	5.1-10	60
	10.1-20	20
	20+	0
White pine (light soils)	0 - 2	100
	2.1- 4	75
	4.1- 6	50
	6.1- 8	10
	8+	0
Oak-pine and loblolly-shortleaf pine types	0 - 2	100
	2.1- 6	75
	6.1- 8	50
	8.1-10	10
	10+	0

Spruce-fir Type

Credit for prospective stocking was given only if the area was cut less than four growing seasons prior to the examination. Isolated individual trees were not recognized as seed sources. Only residual stands or protected groups or strips of trees, containing at least 25 percent spruce or fir trees of seed-bearing character were considered to be seed sources. If seed source was a residual stand, at least 15 spruce or fir seed trees per acre were required.

The standards used for classifying prospective stocking based on proximity to the margin of a group, strip or stand of seed-bearing trees are given under "Prospective Stocking."

White Pine Type

(1) Heavy soils (natural hardwood sites). Prospective stocking was not considered on heavy soils. Unless reproduction of desirable species was present before removal of the final overstory, its establishment subsequent to cutting was considered problematical. Availability of white pine seed sources on cutover areas on such sites is believed to have doubtful influence on the reproduction established after cutting.

(2) Light soils (natural pine sites). Prospective stocking was considered only if the area was cut less than four growing seasons prior to examination. The standards based on number of seed trees left per acre and those based on proximity to the margin of a group, strip or stand of seed-bearing trees are given under "Prospective Stocking."

Maple-beech-birch Type and Oak-hickory Type

Prospective stocking was considered only if the area was cut less than four growing seasons prior to examination. Due to prolific seeding and sprouting ability of species associated with these types, it was considered that the areas would restock fully unless restocking was adversely affected by cull trees, weed trees, herbaceous growth, slash, grazing, deer browsing, etc.

Loblolly-shortleaf Pine Type

Prospective stocking was considered only if the area was cut less than five growing seasons prior to examination. Only pines were accepted as seed trees. The standards based on seed trees and proximity to the margin of a group, strip or stand of seed-bearing trees are shown under "Prospective Stocking." Where seedbeds had been improved by successful prescribed burning, seed tree requirements were reduced to a minimum of 50 percent of those indicated in the tables.

Oak-pine Type

Prospective stocking was considered only if the area was cut less than five growing seasons prior to examination. On good hardwood sites (site index 50+ for oaks or 60+ for gum and poplar) only seed trees of "desirable" species were recognized. On poor hardwood sites, only yellow pines were recognized as seed trees. Heavy seeded hardwoods were not considered as seed trees unless they were within one chain distance of the plot.

The prospective stocking standards are shown under "Prospective Stocking."

Effect of Felling Age

The standards showing the proportion of the mean annual increment at culmination attained at various ages or stump diameters are shown in table 6 for all forest types except the oak-pine type. In this type no felling age factors were applied to hardwoods if the site index on a cutting area was lower than 50 for oaks or hickory, or lower than 60 for sweetgum or yellow-poplar. The felling age factor was then based entirely on the age of the pines cut, and the standards were taken from the table for loblolly-shortleaf pine type.

On better sites, the rating was affected by the age of both the pines and hardwoods cut. The standard for pines was taken from the loblolly-shortleaf pine type and the hardwood species standards from the oak-hickory type.

Table 6.--Percentage of mean annual increment at culmination attained at various sizes or ages, by forest type and by size class of products cut, New England and Middle Atlantic Regions

Stump diameter inside bark (inches)	Spruce-fir type			Maple-beech-birch type	
	Spruce and hardwood		Balsam fir	All hardwood species	
	Sawtimber	Cordwood	All products	Sawtimber	Cordwood
	Percent	Percent	Percent	Percent	Percent
6	..	..	40	..	..
7	..	..	60	..	..
8	..	40	80	..	40
9	..	60	90	..	63
10	40	75	100	40	80
11	50	90	..	50	90
12	60	100	..	65	100
13	70	..	..	..	..
14	80	..	..	80	..
15	88	..	..	..	..
16	94	..	..	90	..
17	98	..	..	..	..
18	100	..	..	95	..
20	..	..	..	100	..

Age (years)	White pine type	Oak-hickory type				Loblolly-shortleaf pine	
	Red and white pine	Yellow-poplar sweetgum		Oak and other hardwoods		Pines and hardwoods	
	All products	Sawtimber	Cordwood	Sawtimber	Cordwood	Sawtimber	Cordwood
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
15	..	..	40	..	..	..	..
20	..	..	60	..	..	..	60
25	..	..	75	..	40	30	80
30	40	..	84	..	60	43	95
35	..	40	90	..	72	63	98
40	65	60	95	..	82	80	100
45	..	..	..	..	92	92	..
50	80	80	100	40	96	100	..
60	92	90	..	62	100	..	..
70	98	95	..	80	..	..	..
80	100	100	..	90	..	..	..
90	..	..	..	100	..	..	..

Forest Type Groups

The following forest type groups and subtypes were recognized in this region:

Aspen-paper birch
Spruce-fir
  Swamp black spruce-tamarack subtype
White-red-jack pine
  Jack-pine subtype
Maple-beech-birch
Oak-hickory

Species Classification

The classification of species by types and sites is shown in table 7.

Existing Stocking

Table 8 shows the number of trees per acre required for 100 percent stocking by forest type and size class.

Prospective Stocking

Aspen-paper Birch Type

During the first two years after cutting, the following conditions were required for a classification of full stocking:

1. Thirty aspen stumps per acre (well distributed over area).

2. Eighty percent of ground area free of brush, heavy sod, cull trees, or other shade.

3. Sandy loam or better soils. If the soil was very light, the examiner made adjustments in line with results in comparable sites in the locality.

Prospective stocking for species other than aspen in this type was determined by standards for those species in other types.

Table 7.--Classification of species according to forest type and site, Lake States Region

Species	Aspen-paper birch type: Site index 60+	Aspen-paper birch type: Site index 45-60	Aspen-paper birch type: Site index under 45 1/	Spruce-fir type: Swamp black spruce tamarack type	Spruce-fir type: Other spruce fir type: Up-land	Spruce-fir type: Other spruce fir type: Swamp	White-red-jack pine type: Jack pine: Site index 50+	White-red-jack pine type: Jack pine: Site index under 50	White-red-jack pine type: Red-white pine: Site index under 65	White-red-jack pine type: Red-white pine: Site index 65+	Maple-beech-birch type: Up-land	Maple-beech-birch type: Low-land	Oak-hickory type: Merchantable height at 60 years, 12 feet or more	Oak-hickory type: Merchantable height at 60 years, under 12 feet
Ash, black	A	..	..	..	..	A	..	..	..	..	A	A	..	..
Ash, green	A	..	..	..	..	..	..	..	..	..	..	..	A	..
Ash, white	D	..	..	..	..	..	A	..	..	..	D	..	D	..
Aspen	D	A	..	..	A	A2/	A	..	A	A	A	A	A	..
Balm-of-Gilead	A3/	..	..	..	A3/	..	..	..	..	..	A3/	A3/	A3/	..
Basswood	D	..	..	..	D	..	A	..	..	A	D	..	D	..
Beech	..	..	..	..	..	..	..	..	..	..	A	..	A	..
Birch, yellow	D	..	..	..	D	A2/	A	..	..	A	D	D	A	..
Birch, paper	D	A	..	..	A	A2/	A	..	..	A	A	A	A	..
Cherry, black	A	..	..	..	..	..	..	..	..	..	A	..	D	..
Elm, American	A	..	..	..	..	A	..	..	..	..	A	D	A	..
Elm, rock	D	..	..	..	..	A	A	..	..	..	D	D	A	..
Elm, slippery	A	..	..	..	..	A	..	..	..	..	A	D	A	..
Fir, balsam	D	D	..	A	D	D	A	..	A	A	A4/7/	D	..	..
Hemlock	D	..	..	..	D	A	A	..	..	A	D	A	..	..
Hickory	..	..	..	..	..	..	..	..	..	..	..	..	A	..
Maple, red	A	..	..	..	..	..	..	..	..	..	A	D	..	..
Maple, sugar	D4/	..	..	..	D4/	..	A	..	..	A4/	D4/	D4/	D4/	..
Oak, black	..	..	..	..	..	..	A5/	..	..	..	..	..	A	..
Oak, bur	A	..	..	..	A	..	A5/	..	..	..	A	A	D	A
Oak, pin	..	..	..	..	..	..	A5/	..	..	..	..	..	..	A
Oak, north. red	D	..	..	..	D	..	A	..	..	A	D	D	D	A
Oak, white	..	..	..	..	..	..	A	..	..	..	..	..	D	..
Pine, jack	D	D	D	..	..	..	D	D	D	A	..	..	..	D
Pine, red	D	D	D	..	D	..	D	D	D	D	..	..	..	D
Pine, white	D	D	A	..	D	D	D	A	D	D	D	D	..	..
Spruce, black	D	A	..	D	D	D	D	A	A	A	..	D	..	..
Spruce, white	D	D	A	A	D	D	D	A	D	D	D	D	..	..
Tamarack	A	..	..	A6/	A	D	..	..	..	..	..	..	..	..
Walnut, black	..	..	..	..	..	..	..	..	..	..	..	..	D	..
White-cedar	A	..	..	A	A	D	..	..	..	A	A	A	..	..

A = Acceptable D = Desirable

1/ Site index under 45 classification was used for all aspen-paper birch type in North Dakota.

2/ Listed as noncount on peat swamps.

3/ Listed as noncount except where it is readily accepted on the market.

4/ Listed as noncount in most of northern Minnesota.

5/ Listed as noncount on sites where site index is under 65.

6/ Listed as desirable if tamarack made up more than 50 percent of stand before cutting.

7/ Listed as desirable in northern Minnesota.

Table 8.--Trees required per acre for full stocking, by tree size and by forest type, Lake States Region

Diameter breast high (inches)	Aspen-paper birch type	Spruce-fir type	White-red-jack pine type: Jack pine	White-red-jack pine type: Red and white pine	Maple-beech-birch type[1]	Oak-hickory type
	Number	Number	Number	Number	Number	Number
Reproduction	1,000	1,000	1,000	1,000	1,000	1,000
2	800	800	800	800	800	800
4	600	600	600	600	600	600
6	360	560	400	500	400	270
8	230	330	260	300	250	180
10	150	210	180	200	175	125
12	110	150	130	140	120	95
14	80	120	100	100	90	71
16	60	100	75	80	70	56
18	48	80	60	62	60	45
20	..	65	..	50	50	37
22	..	50	..	42	40	30
24	..	45	..	35	36	25
26	..	..	..	30	30	..
28	..	..	..	26	26	..
30	..	..	..	22	22	..
32	..	..	..	..	20	..
34	..	..	..	..	17	..
36	..	..	..	..	15	..

1/ Also used for elm-ash-cottonwood stands.

Spruce-fir Type (Except Swamp Black Spruce-tamarack Subtype)

Prospective stocking was considered only if the area was cut less than 5 years prior to examination. Seed trees were recognized only if at least 7 inches d.b.h. for spruce or 5 inches d.b.h. for balsam fir. Twenty such seed trees well distributed over an acre were considered essential for full stocking.

Standards for determining prospective stocking based on proximity to margin of groups, strips or stands of seed-bearing trees were as follows:

Distance from seed source (chains)	Stocking expected (percent)
0 - 2	100
2 - 4	80
4 - 6	60
6 - 8	40
8 - 10	20
10+	0

Spruce-fir Type (Swamp Black Spruce-tamarack Type)

Prospective stocking was considered for any cutting since January 1, 1947 in the black spruce subtype, but for the tamarack subtype prospective stocking was considered only if cutting was done less than 5 years prior to examination.

Individual trees left standing on recent cutovers were not recognized as seed sources because of their susceptibility to windthrow. The following standard was used for determining prospective stocking based on proximity to the margin of groups, strips or stands of seed-bearing trees:

Distance from seed source (chains)	Stocking expected (percent)
0 - 3	100
3 - 6	80
6 - 9	60
9 - 12	40
12 - 15	20
15+	0

White-red-jack Pine Type (Jack Pine Only)

Prospective stocking was considered only if area was cut less than 5 years prior to examination. Seed in slash is very important and was credited in the rating. The importance of mineral soil exposure and absence of ground cover affected the rating. Standards were not specified, but relied on experience and judgment of examiners.

White-red-jack Pine Type (Red and White Pine Only)

Prospective stocking was considered only if cutting was less than 5 years prior to examination. The following standards were used to determine the prospective stocking expected from seed trees:

Seed trees per acre 12 inches d.b.h. and larger (number)	Stocking expected (percent)
2 - 4	20
5 - 7	40
8 - 11	60
12 - 15	80
16+	100

No trees less than 12 inches d.b.h. were recognized as seed trees and no prospective stocking considered from seed margins of green timber.

Maple-beech-birch Type

Prospective stocking was considered only if the stand was cut less than 3 years prior to the examination. Ten seed trees per acre of desirable species not less than 10 inches d.b.h. were credited with producing enough seed to fully restock the area. The following standards for determining prospective stocking based on proximity to an adjacent seed-bearing timber stand were used:

Distance from seed source in multiples of tree height	Stocking expected (percent)
0 - 1	100
1 - 2	50
2 - 3	25
3 - 4	10
More than 4	0

Oak-hickory Type

Prospective stocking was considered only if the stand was cut less than 3 years prior to examination. The seed tree standards for various number of seed trees of different species are shown in table 9.

The standards that follow were used for determining prospective stocking based on proximity to seed source consisting of a margin of trees of seed-bearing age.

Standards for determining prospective stocking, based on proximity to seed source

	Distance from seed source (chains)	Stocking expected (percent)
Heavy-seeded species	0 - 2	100
	2 - 4	50
	4+	20
Light-seeded species	0 - 5	100
	5 - 10	75
	10 - 20	25
	20+	0

Effect of Felling Age

The factors used for adjusting the ratings due to age of timber cut are shown in table 10 for the various forest types and sites recognized.

In the maple-beech-birch type no reduction of productivity rating was made for felling age, if the cutting removed trees which were principally "acceptable" or "noncount" species and there was a good stocking of reproduction of desirable species on the ground. Where the above conditions did not exist, the standards indicated in table 10 were applied.

Felling factors for various species found in the oak-hickory type were taken from other type tables which included the species cut or which had similar growth habits.

Table 9.--Relation of expected stocking to number of seed trees per acre, by tree size class, and type of seed, Lake States Region

Heavy-seeded hardwoods		Light-seeded hardwoods		Stocking expected
12- to 16-inch d.b.h.	17- to 26-inch d.b.h.	12- to 16-inch d.b.h.	17- to 26-inch d.b.h.	
Number	Number	Number	Number	Percent
2	1	..	..	10
4	2	1	..	20
6	3	2	1	30
8	4	..	..	40
10	5	3	..	50
12	6	4	2	60
14	7	..	..	70
16	8	5	..	80
18	9	6	3	90
20	10	7	4	100

Table 10.--Percentage of mean annual increment at culmination attained at various ages by forest type, site class, and size class of products cut, Lake States Region

Age (years)	Aspen-paper birch type[1/]	Spruce-fir type (except swamp black spruce)				Swamp black spruce-tamarack type			White-red-jack pine type						Maple-beech-birch type					
		Balsam-fir	White spruce	Northern white-cedar		Good sites	Medium sites	Poor sites	Jack pine		Red and white pine				Sugar maple, etc.[5/]		Oaks, etc.[6/]		Cottonwood	
											Unmanaged		Managed[4/]							
	Sawtimber	All products	All products	Medium sites[2/]	Good sites[3/]	All products			Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
20	..	..	..	..	..	..	..	..	..	65	..	..	..	..	..	..	..	..	..	20
25	..	..	..	..	..	..	..	..	..	86	..	..	..	..	..	..	..	45	..	60
30	..	60	..	..	..	..	..	..	..	90	..	40	..	..	..	..	..	70	45	80
35	30	75	..	..	..	..	..	..	45	98	..	..	..	..	..	50	..	85	75	95
40	60	85	..	..	..	50	15	..	55	100	40	80	..	65	..	80	..	94	95	100
45	90	95	35	..	..	..	..	..	..	..	..	..	..	..	..	85	..	96	99	..
50	100	100	55	..	65	85	55	..	75	..	65	95	40	85	..	90	35	97	100	..
60	..	..	80	55	85	93	80	15	90	..	85	100	60	95	40	98	60	100	..	..
70	..	..	95	80	97	100	94	45	100	..	..	..	..	..	60	99	80	..	..	..
80	..	..	100	95	100	..	100	80	..	..	98	..	85	100	75	100	95	..	..	..
90	..	..	..	98	..	..	..	..	..	..	..	..	..	..	85	..	98	..	..	..
100	..	..	..	100	..	..	..	100	..	..	100	..	98	..	90	..	100	..	..	..
120	..	..	..	..	..	..	..	..	..	..	..	..	100	..	97	..	..	..	..	..
140	..	..	..	..	..	..	..	..	..	..	..	..	..	..	100	..	..	..	..	..

1/ Cordwood: no deduction for age of cutting.
2/ Medium site is 38 to 55 feet total height at 100 years.
3/ Good site is 55 feet or over in height at 100 years.
4/ A managed stand is one which has been given skillful thinnings or other immediate cuttings.
5/ Includes sugar maple, yellow birch, beech, black ash, and hemlock.
6/ Includes oaks, white ash, green ash, basswood, elm, red maple, and black cherry.

Forest Type Groups

The criteria for rating productivity in the Central Region were based on forest type group and, for one type group, by site also. The following types and sites were recognized:

Bottomland hardwood
Upland hardwood

Excellent sites:	90 feet or more at maturity
Good sites:	70 to 90 feet at maturity
Medium sites:	60 to 70 feet at maturity
Poor sites:	Less than 60 feet at maturity

Oak-pine type
Loblolly-shortleaf pine type (includes Virginia pine)

Species Classification

The classification of species for the various types and sites is shown in table 11.

Existing Stocking

Table 12 shows the number of trees per acre required for full stocking by forest types, sites, and size classes.

Prospective Stocking

Hardwood Types

Full credit for the ability of the hardwood forest types to restock was given if the logging and associated swamping resulted in stumps mostly from desirable species which sprout prolifically and of a small enough size to insure sprouts developing into crop trees.

If the logging resulted in large stumps or those of species incapable of sprouting, or if the stumps consisted largely of acceptable or non-count species, the rating was then based largely on the adequacy of the seed source.

The standards for individual seed trees and for adjacent margins of seed-bearing stands were identical to the standards used for the oak-hickory forest type in the Lake States Timber Resource Review Region.

Table 11.--Classification of species according to forest type and site, Central Region

Species	Bottom-land hardwood type	Upland hardwood type				Loblolly-shortleaf pine and oak-pine types1/
		Excellent sites	Good sites	Medium sites	Poor sites	
Ash	D	D	D	..	..	..
Aspen	..	..	A	..	..	..
Basswood	..	D	D	..	..	..
Beech	..	A	A	A	..	..
Blackgum	..	A2/	A	A	..	..
Buckeye	..	A	A	A	..	..
Cherry, black	..	D	D	..	..	..
Cottonwood	D	A	A	..	..	..
Cypress	D	..	..	..	..	..
Elms	A	A	A	A	..	..
Hackberry	A	A	A	A	..	..
Hemlock	..	A3/	A	..	..	..
Hickory	A	A	A	A	..	..
Locust, black	..	A	A	A	..	..
Locust, honey	A	..	..	..	..	..
Maple, red	D4/	A	A	A	..	..
Maple, sugar	..	A5/	A5/	A	..	..
Oak, black	..	A3/	D	D	D4/	A
Oak, bur	..	D	D	D	..	..
Oak, chestnut	..	A	A	D	D	..
Oak, pin	A6/	..	A	A	A	..
Oak, post	..	..	A	A	A	..
Oak, red	D	D	D	D	A	A
Oak, scarlet	..	A	A	A3/	A	A
Oak, white	D	D	D	D	A	A
Pines	..	..	D	D	D	D
Redcedar	..	..	..	D	D	A
Sweetgum	D	A	D	A	..	..
Sycamore	D	A	A	..	..	..
Walnut, black	..	D	D	A	..	..
Yellow-poplar	D	D	D	D	..	A

D = desirable species A = acceptable species

1/ For these types in eastern Kentucky the classification for upland hardwoods, medium site, was used in lieu of the classification in this column.

2/ Listed as noncount in all States except Kentucky.

3/ Listed as desirable in Kentucky.

4/ Listed as acceptable in Kentucky.

5/ Listed as desirable in eastern Kentucky and northern part of region.

6/ Listed as desirable on tight-soiled pin oak flats.

Table 12.--Trees required per acre for full stocking, by tree size, by forest type and site, Central Region

Diameter breast high (inches)	Hardwood and oak-pine types				Loblolly-shortleaf pine type
	Excellent sites 1/	Good sites 2/	Medium sites	Poor sites	
	Number	Number	Number	Number	Number
Reproduction	1,000	1,000	1,000	1,000	1,000
2	800	800	800	800	800
4	600	600	600	600	600
6	450	400	360	300	400
8	280	240	220	170	230
10	190	155	145	110	155
12	140	115	100	80	115
14	105	90	80	60	90
16	80	70	60	45	72
18	66	55	46	35	60
20	55	45	38	30	50
22	45	38	31	25	42
24	38	32	26	20	35
26	33	27	..	..	..
28	28	23	..	..	..
30	24	20	..	..	..
32	21	..	..	..	..
34	19	..	..	..	..
36	17	..	..	..	..

1/ This standard was used for most bottomland hardwood sites and for the best of the upland hardwood sites.

2/ This standard also used for all sites of the maple-beech-birch forest type and the best of the oak-pine sites.

Loblolly-shortleaf Pine Type

The standards used for prospective stocking in the pine type were as follows:

Diameter breast high (inches)	Average number of pines required per acre to rate 100 percent for seed-tree requirements
8	20
10	15
12	12½
14	10
16	7½
18+	4½

Standards for determining prospective stocking, based on proximity to pine seed source

	Good seed source (percent)	Fair seed source[1/] (percent)	Poor seed source (percent)
Distance from seed source (chains):			
0 - 2	100	100	30
2 - 4	100	80	20
4 - 6	100	40	10
6 - 8	80	30	5
8 - 10	40	10	0
10 - 12	10	5	..
12+	0	0	..

1/ In Kentucky this column only was used.

Classification of adjacent timber stands as a "good," "fair," or "poor" seed source was determined by field examiners on the basis of judgment.

Effect of Felling Age

The felling age factors showing the effect on growth of cutting trees prior to the culmination of the mean annual increment are shown in table 13 for various species and sites.

Table 13.--Percentage of mean annual increment at culmination attained at various ages, by forest type, site class, and size class of products cut, Central Region

Age (years)	Excellent site hardwoods							Good site hardwoods				Medium and poor site hardwoods						Shortleaf pine7/			
	Oaks, etc. 1/		Basswood, etc.2/		Sweetgum, elm		Cottonwood3/	Basswood, etc.4/		Oaks, etc.5/		Black-oak redcedar		Scarlet oak, etc.6/		Other oaks		Site index 60		Site index 70	
	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
20	..	20	..	70	..	70	..	..	60	..	..	..	..	..	..	..	..	..	50	..	60
25	..	45	30	80	15	90	40	..	75	..	45	..	40	..	40	..	..	..	75	..	80
30	..	70	55	87	30	95	60	40	85	..	60	..	60	..	60	..	40	..	93	40	95
35	..	85	65	95	45	98	85	50	90	..	75	..	85	30	85	..	70	46	98	60	98
40	15	95	75	100	60	100	100	60	95	..	95	40	95	60	95	..	90	63	100	80	100
45	30	98	80	..	70	..	..	70	99	..	98	60	100	80	100	..	95	77	..	92	..
50	45	100	85	..	80	..	..	80	100	40	100	75	..	90	..	..	100	89	..	100	..
55	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	96	..	..	..
60	75	..	90	..	90	..	..	85	..	70	..	90	..	100	..	30	..	100	..	..	..
70	85	..	95	..	95	..	..	95	..	85	..	100	..	..	..	55	..	..	..	..	..
80	95	..	100	..	100	..	..	100	..	96	..	..	..	..	..	75	..	..	..	..	..
90	100	..	..	..	..	..	..	..	..	100	..	..	..	..	..	95	..	..	..	..	..
100	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	100	..	..	..	..	..

1/ Oaks, sugar maple, beech, walnut, and hickory.
2/ Basswood, yellow-poplar, ash, red maple, sycamore.
3/ No felling age factors were recognized for cordwood products due to the very early growth culmination of cottonwood for this class of material in the region.
4/ Basswood, yellow-poplar, ash, red maple, sycamore, elm.
5/ Oaks and species other than those listed in 3/.
6/ Scarlet oak, and hickory in Kentucky.
7/ For hardwood species associated with the pine type most appropriate hardwood standards were used.

Lake States criteria were applied in the survey of North Dakota, and criteria of the West Gulf Region were applied to the Plains portions of Oklahoma and Texas. The standards given in the following Plains Region portion of this summary of criteria were used in South Dakota, Nebraska, and Kansas. For these States the point system of sampling developed for the West was used.

Forest Type Groups

The following forest type groups were recognized in this region:

Oak-hickory
Elm-ash-cottonwood
  Cottonwood subtype

With the exception of those for the cottonwood subtype, the productivity standards for the oak-hickory and the elm-ash-cottonwood type group were identical.

Species Classification

The following species classification was used for all types in this region:

Desirable Species	Acceptable Species
Ash	Basswood
Hackberry (acceptable in Kansas)	Cottonwood (desirable in cottonwood subtype)
Oak, bur	Coffeetree, Kentucky
Oak, chestnut	Elms
Oak, red	Hickories
Walnut, black	Maple, red
	Mulberry, red
	Redcedar

Existing Stocking

Table 14 shows the standards used to determine existing stocking at each sample point. Seedlings, saplings and, in some instances, poles were counted if they fell within 1, 2, or 4-milacre circular plots, as indicated in the table. Larger trees were counted if they occurred within the maximum distance from the point indicated for each d.b.h. class in the table.

Table 14.--Trees per acre and maximum distance from point required for full stocking, by diameter class, and by forest type group and subtype, Plains Region

Diameter breast high (inches)	All hardwood types (except cottonwood subtype)		Cottonwood subtype	
	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point
	Number	Feet	Number	Feet
Reproduction	1,000	3.7	1,000	3.7
2	800	4.1	800	4.1
4	600	4.8	600	4.8
6	400	5.9	450	5.6
8	240	7.6	280	7.0
10	155	9.5	190	8.6
12	115	11.0	140	9.9
14	90	12.4	105	11.5
16	70	14.1	80	13.2
18	55	15.9	66	14.5
20	45	17.8	55	15.9
22	38	19.1	45	17.8
24	32	20.8	38	19.1
26	27	22.7	33	20.5
28	23	24.6	28	22.3
30	20	26.3	24	24.0
32	..	..	21	25.7
34	..	..	19	27.0
36+	..	..	17	28.6

Prospective Stocking

Cutover bottomlands and mixed hardwoods were considered capable of restocking fully if prospective reproduction would be free to grow, and the area was not subject to damage by fire or grazing. Under less favorable conditions, the prospective stocking rating was based on seed source, expected sprouting, amount of area occupied by slash, grass, brush, culls, etc., and damage by grazing or fire. If 50 percent of the 4-milacre quadrat surrounding the point was free of brush, rock, etc., and if there was an adequate seed source, the point was considered prospectively stocked, provided there was no evidence of grazing within the past 5 years. An adequate seed source was considered to be one or more desirable seed trees not more than 2 chains from the point for heavy-seeded species or 5 chains from the point for light-seeded species. If there was a stump of 4 inches or less, capable of producing sprouts within 7½ feet of the point and no evidence of recent grazing or burning, the point was considered potentially stocked.

Effect of Felling Age

Whenever significant clear cuttings were encountered in stands below rotation age, appropriate adjustment factors were recorded according to the standards in table 15.

Table 15.--Percentage of mean annual increment at culmination attained at various ages, by forest type, site, and size class of products cut, Plains Region

Age (years)	Oak-hickory and elm-ash-cottonwood (except cottonwood subtype)				Cottonwood subtype1/			
	Good site2/		Poor site3/		Cottonwood		Other species	
	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
20	..	..	..	..	..	20	..	..
25	..	45	..	..	..	60	..	43
30	..	60	..	40	45	80	..	69
35	..	75	..	70	75	95	..	85
40	..	95	..	90	95	100	38	95
45	..	98	..	95	99	..	48	100
50	40	100	..	100	100	..	58	..
60	70	..	30	..	..	..	73	..
70	85	..	55	..	..	..	84	..
80	96	..	75	..	..	..	91	..
90	100	..	95	..	..	..	95	..
100	..	..	100	..	..	..	97	..
110	..	..	..	..	..	..	98	..
120	..	..	..	..	..	..	100	..

1/ For sites where total height of mature trees is more than 90 feet. For poorer sites, standards for other type were used based on height of mature trees.

2/ Good sites = total height of mature trees 70 feet or more.

3/ Poor site = total height of mature trees less than 70 feet.

Forest Type Groups

The following type groups were recognized in these regions:

Loblolly-shortleaf pine (including Virginia pine)
Longleaf-slash pine
Oak-hickory
Oak-gum-cypress
Oak-pine (includes the small area of spruce-fir type)

Species Classification

The classification of species for various forest type groups is shown in table 16.

Existing Stocking

A composite table for all forest types was used in the southern TRR regions for determining existing stocking. The corresponding density standard this represents is shown in table 17.

Table 16.--Classification of species according to forest type, South Atlantic, Southeast, and West Gulf Regions

Species	Forest type: Loblolly-shortleaf pine	Longleaf-slash pine	Oak-hickory	Oak-gum cypress	Oak-pine1/	Species	Forest type: Loblolly-shortleaf pine	Longleaf-slash pine	Oak-hickory	Oak-gum cypress	Oak-pine1/
Ash	..	..	D	D	D	Oak, overcup	..	..	..	A	..
Basswood	..	..	D	..	A	Oak, pin	..	..	..	..	A
Birch	..	..	A	..	A	Oak, post	..	..	..	A	..
Blackgum	..	..	..	A	..	Oak, north. red	..	A	D	D	D
Butternut	..	..	A	..	A	Oak, south. red	..	A	A	A3/	D
Cherry, black	..	..	A	..	D2/	Oak, scarlet	A	..	..	..	A
Cottonwood	..	..	..	D	..	Oak, shingle	..	..	..	..	A
Cucumbertree	..	..	..	D	A	Oak, Shumard	..	..	..	D	..
Cypress, bald	..	A	..	D	..	Oak, water	..	..	..	D4/	A
Cypress, pond	..	A	..	A	..	Oak, white	A	A	D	D3/	D
Dogwood	..	..	A	..	..	Oak, willow	..	..	..	D4/	..
Elm	..	..	A	A	A	Pecan	..	..	..	A	..
Fir, Fraser	..	..	..	..	D2/	Persimmon	..	..	..	A	..
Hackberry	..	..	..	A	..	Pine, loblolly	D	A	D	D	D
Hemlock, eastern	..	..	A	..	D2/	Pine, longleaf	A	D	D	..	..
Hemlock, Carolina	..	..	A	..	A2/	Pine, pitch	..	..	A	..	D
Hickory	..	..	..	A	..	Pine, pond	A	A	..	..	..
Locust	..	..	A	A	A	Pine, sand	..	A	..	..	..
Magnolia	..	..	D	D	..	Pine, shortleaf	D	A	D	..	D
Maple, red	A	..	A	A	A	Pine, slash	A	D	..	..	..
Maple, silver	..	..	A	A	A	Pine, spruce	A	A	..	D	..
Maple, sugar	..	..	D	..	D2/	Pine, Virginia	A5/	..	A	..	D
Mulberry	..	..	..	A	..	Pine, white	..	..	D	..	D
Oak, black	A	..	D	A3/	D	Redcedar	..	..	..	..	D
Oak, bur	..	..	..	A	..	Spruce, red	..	..	..	..	D2/
Oak, cherrybark	..	A	D	D	D	Sweetbay	..	..	..	A	..
Oak, chestnut	..	..	A	..	D	Sweetgum	..	..	D	D	D
Oak, chinquapin	..	..	D	..	D	Sycamore	..	..	..	A	..
Oak, cow	..	..	..	D	..	Tupelo	..	..	..	A	..
Oak, diamondleaf	..	..	..	A3/	..	Walnut, black	..	..	D	..	D
Oak, Nuttall	..	..	..	D4/	..	Willow, black	..	..	..	D6/	..
						Yellow-poplar	A	..	D	D	D

A = Acceptable species   D = Desirable species

1/ The small area of spruce-fir type in the southern regions was included with oak-pine.
2/ Pertains to classification of this species in the spruce type.
3/ Listed as desirable on good sites.
4/ A desirable tree must have at least a No. 2 log or better or be capable of producing such. On poor sites rate as acceptable or noncount depending on condition of tree.
5/ Listed as desirable in the upper Piedmont or mountain foothills.
6/ Listed as noncount except along Mississippi River.

Table 17.--Trees per acre required for full stocking, by tree size, South Atlantic, Southeast, and West Gulf Regions

Diameter breast high (inches)	Trees per acre	Diameter breast high (inches)	Trees per acre
	Number		Number
Reproduction	1,000	20	51
2	800	22	42
4	590	24	36
6	400	26	31
8	240	28	27
10	155	30	24
12	115	32	21
14	90	34	19
16	72	36	17
18	60	38	15

Prospective Stocking

Loblolly-shortleaf Pine Type and Longleaf-slash Pine Type

Standards for prospective stocking based on seed trees and proximity to a seed source consisting of a group, strip or stand of seed-bearing trees were as follows:

D.b.h. (inches):	Average number of pines required per acre to rate 100 percent for seed-tree requirements: Longleaf-slash pine type--longleaf and slash pine (number)	Average number of pines required per acre to rate 100 percent for seed-tree requirements: Loblolly-shortleaf pine type--all pines except longleaf and slash (number)
10	12	15½
12	10	12½
14	6	10
16	4	7½
18	4	4½

Standards for determining prospective stocking, based on proximity to seed source

	Distance from seed source (chains)	Stocking expected (percent)
Longleaf pine.	0 - 2	100
	2 - 3	90
	3 - 4	70
	4 - 5	50
	5 - 6	30
	6 +	0
Other southern pines	0 - 2½	100
	2½ - 3½	90
	3½ - 4½	70
	4½ - 5½	50
	5½ - 6½	30
	6½ - 7½	10
	7½ +	0

Oak-hickory Type, Oak-gum-cypress Type, and Oak-pine Type

Due to the prolific sprouting and seed-bearing habits of species associated with these types, it was assumed that under normal conditions satisfactory reproduction would become established unless culls, weed trees, grazing, etc., prohibited its establishment and growth.

Effect of Felling Age

Table 18 lists the standards used for all forest types in the southern TRR regions, except the oak-pine type.

In the oak-pine type, if the site was primarily a pine site, the appropriate pine felling age factor was applied if premature pine cutting was found, but no felling factor was applied to the hardwoods cut, regardless of their age. Thus, the productivity rating was not lowered if the cutting of young hardwoods served to stimulate regeneration or growth of pines. However, on sites in the oak-pine type which were primarily hardwood sites, hardwood felling factors were applied to the rating where the cutting of young hardwoods occurred. Under this situation in the oak-pine type the hardwood standards of table 6 were used.

Table 18.--Percentage of mean annual at culmination attained at various ages, by forest type, species, and size class of products cut, South Atlantic, Southeast, and West Gulf Regions

Age (years)	Loblolly-shortleaf pine type[1]				Longleaf-slash pine type[2]			Oak-hickory type				Oak-gum-cypress type	
	Loblolly pine		Shortleaf pine[3]		Longleaf pine		Slash pine[4]	Oak-hickory		Sweetgum and yellow-poplar		All species	
	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Sawtimber	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
10	..	42	..	..	..	..	..	..	..	..	..	..	..
15	..	66	..	48	..	48	..	..	..	..	40	..	..
20	33	80	..	66	32	67	36	..	..	..	60	..	60
25	57	90	28	82	45	81	60	..	43	..	75	..	75
30	75	96	43	94	58	89	79	..	62	..	84	..	84
35	88	100	63	98	70	95	91	32	74	40	90	44	90
40	96	..	80	100	78	98	100	43	85	60	95	68	95
45	100	..	92	..	84	100	..	54	92	..	..	..	..
50	..	..	100	..	94	..	..	64	100	80	100	81	100
55	..	..	..	..	98	..	..	72	..	..	..	..	..
60	..	..	..	..	100	..	..	79	..	90	..	90	..
65	..	..	..	..	..	..	..	84	..	..	..	..	..
70	..	..	..	..	..	..	..	89	..	95	..	94	..
75	..	..	..	..	..	..	..	91	..	..	..	..	..
80	..	..	..	..	..	..	..	94	..	100	..	98	..
85	..	..	..	..	..	..	..	97	..	..	..	..	..
90	..	..	..	..	..	..	..	100	..	..	..	100	..

1/ When loblolly pine was the predominating species in the stand, the loblolly standards were used. When shortleaf or other southern pines predominated, the shortleaf standards were used.
2/ When longleaf pine was the predominating species in the stand, the longleaf standards were used. When slash pine predominated, the slash pine standards were used.
3/ These standards were used for Virginia pine and other southern pines.
4/ No deduction for cordwood.

STANDARDS FOR THE PACIFIC NORTHWEST, CALIFORNIA, AND COASTAL ALASKA REGIONS

Forest Type Groups

These three regions are treated as a group in this summary because of similarities in the standards used. The timber types recognized for each region are listed below:

California	Pacific Northwest	Alaska
Douglas-fir	Douglas-fir	Hemlock-Sitka spruce
Ponderosa pine	Ponderosa pine	
Western white pine	Western white pine	
Fir-spruce	Fir-spruce	
Redwood	Hemlock-Sitka spruce	
	Lodgepole pine	
	Hardwoods	
	Western larch	

Species Classification

The desirability of the species was classified by forest type, region and subdivision thereof as shown in table 19.

Table 19.--Classification of species according to timber type,[1] region, and subregion, Pacific Northwest, California, and Coastal Alaska Regions

Species	Douglas-fir type: Washington and Oregon, East side	Douglas-fir type: Washington and Oregon, West side	Douglas-fir type: California	Ponderosa pine type: California, East side	Ponderosa pine type: California, West side	Ponderosa pine type: Washington and Oregon, East side	Ponderosa pine type: Washington and Oregon, West side	Hemlock-Sitka spruce type: Washington and Oregon	Hemlock-Sitka spruce type: Alaska	Western white pine type: Washington and Oregon	Western white pine type: California	Fir-spruce type: Washington and Oregon, East side	Fir-spruce type: Washington and Oregon, West side	Fir-spruce type: California	Western larch type: Washington and Oregon	Redwood type: California	Hardwoods type
Alder, red	..	A	..	..	..	..	..	A	..	..	..	..	..	..	..	..	..
Ash, Oregon	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Birch, white	..	..	..	..	..	..	..	..	D3/	..	..	..	..	..	..	..	A2/
California-laurel	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	A2/
Cottonwood, black	..	A	..	..	..	..	..	..	D	..	..	..	..	..	..	..	..
Douglas-fir	D	D	D	A	D	D	D	D	..	D	D	D	D	D	D	D	..
Fir, alpine	..	..	..	..	..	..	..	..	..	..	..	A	A	..	..	..	..
Fir, grand	..	A4/	..	..	..	..	..	A	..	..	..	..	..	..	..	..	..
Fir, lowland white	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	A	..
Fir, noble	..	D	..	..	..	..	..	..	..	..	..	D	..	..	..	..	..
Fir, Pacific silver	..	A4/	..	..	..	..	..	D	..	..	..	..	D	..	..	..	..
Fir, Shasta red	..	..	..	..	..	..	..	..	..	..	..	D	D	D	..	..	..
Fir, white	A	..	A	A	A	A	A	..	..	A	A	D	..	D	A	..	..
Hemlock, mountain	..	..	..	..	..	..	..	..	A	..	..	D	D	..	..	..	..
Hemlock, western	..	D5/	A	..	..	..	..	D	D	..	..	..	D	..	..	A	..
Incense-cedar	A	A	A	A	A	A	A	..	..	..	A	..	..	A	..	..	..
Larch, western	D	..	..	..	..	A	..	..	..	..	..	..	..	..	D	..	..
Maple, bigleaf	..	A	..	..	..	..	..	A	..	..	..	..	..	..	..	..	..
Oak, Oregon white	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	A2/
Pine, Jeffrey	..	..	..	D	D	..	..	..	..	..	D	..	..	D	..	..	..
Pine, lodgepole	A	..	..	..	..	A	..	..	A	..	..	A	A	..	A	..	..
Pine, ponderosa	D	D	D	D	D	D	D	..	..	D	D	..	..	D	D	..	..
Pine, sugar	D6/	D6/	D7/	D7/	D7/	D6/	D6/	..	..	D6/	D7/	..	..	D7/	..	..	..
Pine, western white	A	A	..	..	..	..	..	..	..	D	..	D	D	..	D	..	..
Port-Orford-cedar	..	D	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Redwood	..	..	D	..	..	..	..	..	..	..	..	..	..	..	..	D	..
Redcedar, western	..	D5/	..	..	..	..	..	D	A	..	..	..	..	..	..	..	..
Spruce, black	..	..	..	..	..	..	..	..	A	..	..	..	..	..	..	..	..
Spruce, Engelmann	..	..	..	..	..	A	..	..	..	..	..	D	A	..	D	..	..
Spruce, Sitka	..	..	..	..	..	..	..	D	D	..	..	..	..	..	..	D	..
Spruce, white	..	..	..	..	..	..	..	..	D3/	..	..	..	..	..	..	..	..
Tanoak	..	A	..	..	..	..	..	..	..	..	..	..	..	..	..	..	A
Yellow-cedar, Alaska	..	..	..	..	..	..	..	..	A	..	..	..	A	..	..	..	..

1/ Lodgepole pine type: All species classified as desirable.
2/ For some localities these species are desirable. Example: Pure stands of ash within overflow areas; pure stands of oak in Willamette Valley; pure patches of California-laurel.
3/ On the Kenai Peninsula of the Coastal area.
4/ These species were classified as desirable when found on areas ecologically suited to them.
5/ These species were classified as acceptable when found on sites which were severe because of lack of moisture caused by shallow soil or exposure.
6/ Sugar pines and western white pines outside of blister rust control areas were not counted as crop trees unless they were 12 inches d.b.h. or larger and free of blister rust stem cankers.
7/ Outside of blister rust control zones, sugar pines under 6 inches d.b.h. on low rust-hazard areas, 12 inches d.b.h. on medium rust-hazard areas, and 20 inches d.b.h. on high rust-hazard areas were considered noncount trees. Sugar pines bearing rust cankers were not counted as crop trees.

Existing Stocking

Table 20 summarizes the standards used to determine existing stocking at observation points in the Pacific Northwest Region. Points were considered stocked if crop trees of the indicated age or size were found within the distances shown in the table.

Integration of the stocked quadrat method with the point sampling system for determination of stocking of reproduction in the West warrants special discussion. The following tabulation relates the entries in tables 20 and 21 for seedlings and saplings to conventional measures by the stocked quadrat method:

Entries from table 20: Minimum trees per acre (number)	Entries from table 20: Maximum distance from point (feet)	Equivalent minimum of trees per quadrat required for a stocked point (number)
1000	3.7	1 per 1-milacre quadrat
750	7.4	3 per 4-milacre quadrat
500	7.4	2 per 4-milacre quadrat
250	7.4	1 per 4-milacre quadrat

An interpretation of the entries in table 20 can be illustrated by (1) observing that the entries for established seedlings under 6 inches tall in the western white pine type are a minimum of 500 trees per acre and a point distance of 7.4 feet, (2) reference of these entries to the tabulation above shows that at least 2 established seedlings less than 6 inches tall must be present on a 4-milacre quadrat (circular plot having a 7.4-foot radius) before the observation point (or center of the quadrat) is considered stocked.

Table 20.--Minimum number of trees per acre and maximum distance from observation point used in classifying existing stocking in the Pacific Northwest Region, by tree age or size, forest type, and site index

Age or size of established seedling and crop tree d.b.h.	Douglas-fir, larch hemlock-spruce, fir-spruce hardwood type		Ponderosa pine type						Western white pine type		Lodgepole pine type	
			Site index 60		Site index 80		Site index 100					
	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point
	Number	Feet	Number	Feet	Number	Feet	Number	Feet	Number	Feet	Number	Feet
Under 2 years	750	7.4	..	..	..	..	..	..	..	..	..	..
2 yrs. to 9" d.b.h.	250	7.4	..	..	..	..	..	..	..	..	..	..
4" high to 5" d.b.h.	..	..	..	..	..	..	..	..	..	..	1,000	1/3.7
Under 6" high	..	..	500	7.4	500	7.4	500	7.4	500	7.4	..	..
6" high to 8" d.b.h.	..	..	250	7.4	250	7.4	250	7.4	..	..	..	..
6" high to 10" d.b.h.	..	..	..	..	..	..	..	..	250	7.4	..	..
6" d.b.h.	..	..	..	..	..	..	..	..	..	..	653	4.6
7	..	..	..	..	..	..	..	..	..	..	479	5.4
8	..	..	..	..	..	..	..	..	..	..	367	6.2
9	..	..	190	8.5	215	8.0	250	7.4	..	..	290	6.9
10	223	8.0	154	9.5	174	8.9	209	8.1	..	..	235	7.7
12	168	9.2	107	11.4	121	10.7	145	9.7	166	9	163	9.2
14	133	10.3	79	13.3	89	12.5	107	11.4	122	11	120	10.8
16	108	11.4	60	15.2	68	14.3	82	13.0	93	12	92	12.3
18	90	12.5	48	17.1	54	16.1	64	14.7	74	14	72	13.8
20	76	13.6	39	19.0	44	17.8	52	16.3	60	15	59	15.3
22	..	..	32	20.9	36	19.6	43	17.9	41	18	..	..
24	58	15.6	27	22.8	30	21.5	36	19.5	30	21	..	..
26	..	..	23	24.7	26	23.1	31	21.2	23	25	..	..
28	46	17.5	20	26.6	22	25.1	27	22.8	18	28	..	..
30	..	..	17	28.5	19	27.0	23	24.4	11	31	..	..
32	36	19.2	15	30.4	17	28.6	20	26.1	..	..	..	..
34	..	..	13	32.2	15	30.8	18	27.7	..	..	..	..
36	30	20.8	12	34.1	13	32.6	16	29.3	..	..	..	..
38	..	..	11	36.1	12	34.0	14	31.0	..	..	..	..
40	25	22.0	10	38.0	11	35.5	13	32.6	..	..	..	..
42+	..	..	7	44.6	8	41.6	9	38.2	..	..	..	..

1/ Overstocking was considered the equivalent of nonstocking under the following conditions: (a) 20 or more seedlings 4 inches to 12 inches high per milacre (b) 10 or more trees 12 inches tall to 1 inch d.b.h. per milacre quadrat.

Table 21.--Trees per acre and maximum distance from observation point used in classifying existing stocking in the redwood forest type group, California Region

Tree size	Minimum trees per acre	Maximum distance from observation point
	Number	Feet
Under 6 inches high	500	7.4
6 inches high to 12 inches d.b.h.	250	7.4
14 inches d.b.h.	234	8
16	179	9
18	141	10
20	114	11
24	80	13
28	58	15
32	45	18
36	35	20
40	29	22
50	18	28
60+	13	33

The standards of table 20 were applied in California with the following adaptations or additions:

1. For the Douglas-fir type, existing stocking of seedlings, saplings and small poles was determined by the following:

Size class of tree	Minimum of trees per acre (number)	Maximum distance from point (feet)
Less than 6 inches high	500	7.4
6 inches high to 9 inches d.b.h.	250	7.4

2. For the ponderosa pine type east of the Sierra summit, the standards of table 20 for Site Index 80 were applied.

3. For the ponderosa pine, western white (and sugar) pine and fir-spruce types west of the Sierra summit, the standards in table 20 for the western white pine type were applied.

4. Table 21 presents the standards for the redwood type.

In Coastal Alaska, the standard used for the hemlock-Sitka spruce type group was identical to that used for the corresponding type group in the Pacific Northwest (table 20).

Prospective Stocking

Douglas-fir and Other Type Groups West of the Cascade Summit in the Pacific Northwest

The standards for prospective stocking discussed in this section were applied to the Douglas-fir, fir-spruce, western larch, hemlock-Sitka spruce and under some situations to the western white pine type groups of the Pacific Northwest Region. They were applied in the western white pine type when the species associated with western white or sugar pine were representative of the types mentioned above. If the species associated with western white pine or sugar pine were representative of the ponderosa pine type, standards for the ponderosa pine type were applied. In neither situation was western white or sugar pine considered as a seed source if the area under examination was located outside blister rust control zones.

The factors affecting prospective stocking in these types were classified into three categories: (1) adequacy of seed source, (2) condition of seedbed, and (3) slope and exposure. At each observation point not stocked, the adequacy of seed source was examined and given a numerical rating ranging from 0 to 4. Seedbed condition was assigned a rating of 0 to 3, and slope and exposure was given a rating of 1 to 3 depending on the degree of severity. These three separate ratings were then added together and if the sum was 7 or more the point being examined was classed as "stocking in prospect"; if the total amounted to less than 7, the point was recorded as "stocking not in prospect." Any point with a zero seed source or a zero

seedbed rating was classed as "stocking not in prospect" regardless of the rating assigned the other two factors.

Seed source standards--the basis for classifying seed source is summarized in table 22. The second and third columns of this table show the seeding distances considered effective in clearcut areas where the seed source consists of surrounding or adjacent timber. Columns 4 to 7 show the relative effectiveness attributed to seed trees at varying distances. The last column of table 22 shows the number of first-year seedlings considered necessary to indicate prospects of successful future stocking. Such seedlings, less than 1 year old, have such a high mortality rate that they were not judged to constitute satisfactory standards for existing stocking. However, their presence attests to the fact that seed reaches the point locality.

In applying table 22, the rating for "distance to timber edge" was based on the distance to the nearest timber edge, or, if two or more edges were present, on the sum of the ratings for distance to the two nearest timber edges. If, in addition, seed trees and first-year seedlings were present, the rating value for seed from these sources was added to that for "distance to timber edge." Short timber, i.e., that less than 150 feet tall, was required, in the judgment of the field examiner, to be of seed-bearing size. In no case was a total rating of seed source either separately or in combination with timber edge, two nearest timber edges, seed trees or first-year seedlings given a value of more than 4.

Seed-tree classification--the seed-tree data in table 22 refers to standard seed trees. For seed trees above standard, corresponding rating values of column 1 were multiplied by $1\frac{1}{2}$; for substandard seed trees, the ratings were multiplied by $\frac{1}{2}$.

A standard seed tree, as referred to in table 22, was required to meet the general seed tree definition and in addition was 12 inches or larger in d.b.h. if hemlock, cedar or spruce, or 18 inches or larger in d.b.h. if of other species, including Douglas-fir, and was also required to have a live crown length equal to 1/6 to 1/3 of total tree height. Seed trees considered above standard met the above specifications but, in addition, had a live crown length more than 1/3 of total tree height.

Substandard seed trees were recognized as trees of seed-bearing size and age which did not meet d.b.h. or crown requirements of standard seed trees, but did meet the general seed-tree definition in other respects.

Table 22.--Classification of seed sources for the Douglas-fir and other type groups west of the Cascade summit in the Pacific Northwest

Rating value	Distance from point to timber edge		Number of standard seed trees by tree-height distance class from point				First-year seedlings on 4-milacre plot
	Tall timber (150+ feet)	Short timber (under 150 feet)	0-1	1-2	2-3	3-4	
	Chains	Chains	Number	Number	Number	Number	Number
4	0-10	0-5	4	11+	32+	95+	..
3	11-20	6-10	3	8-10	23-31	68-94	3
2	21-25	11-15	2	5-7	14-22	41-67	2
1	26-40	16-25	1	2-4	5-13	14-40	1
1/3	..	..	..	1	2-4	6-13	..
0	41+	26+	0	0	0	0	0

Seedbed condition--the basis for classifying seedbed conditions for the Douglas-fir and other type groups west of the Cascade summit in the Pacific Northwest is summarized as follows:

Rating value	Seedbed condition on a 4-milacre quadrat
3 (Good)	(a) 50 percent or more of surface favorable for seedling establishment and growth, or (b) 2 seedlings less than 2 years old and free to grow.
2 (Fair)	(a) 20 percent to 50 percent of surface favorable for seedling establishment and growth, or (b) 1 seedling less than 2 years old and free to grow.
1 (Poor)	(a) Less than 20 percent favorable for seedling establishment and growth, or (b) 1 or more seedlings less than 2 years old in a questionable position for normal development.
0 (Very poor)	Not likely to restock. A rating of zero resulted in classing the point as "no stocking in prospect," regardless of the value assigned in the rating of other factors.

The judgment and experience of local field examiners in interpreting the classification of seedbed conditions was supplemented by the following guides:

Favorable seedbed: Uncompacted mineral soil is basic for ideal seedbed conditions. In addition to receptive soil, the following surface conditions are favorable: (1) a light vegetative shade of approximately 20 percent (below and above 20 percent density cover conditions become progressively less favorable), and (2) dead shade from logs, stumps, and light slash.

Unfavorable: Generally the following conditions are indicative of a zero rating for seedbed conditions: (1) perennial grasses occupying 80 percent or better of the quadrat; (2) herbaceous cover using 80 percent or more of the area (includes overhead shade as well as stem and root competition); (3) accumulation of debris, duff, rotten wood, etc., which are known to be unfavorable for the species rated; and (4) when noncount species dominate the 4-milacre plot.

Slope and exposure--the basis for classifying slope and exposure conditions for type groups west of the Cascade summit in the Pacific Northwest follows:

Rating value	Plot condition
3 (Good)	Slope and exposure not a factor concerning seedling survival and development.
2 (Fair)	Survival of seedlings questionable during periods of dry weather.
1 (Poor)	Conditions difficult for seedling survival--such as dry, exposed south and southwest slopes which approach 45 percent, exposed hard compact surfaces, etc.

Slope and exposure were not considered limiting factors for seed germination, but were considered to have a pronounced effect on seedling survival. South and southwest slopes which approximate a gradient of 45 percent present the most unfavorable conditions. On the other hand, north and northeast slopes which approximate 45 percent appear to be the most favorable. From this it was assumed that level land, gentle slopes up to 20 percent northwesterly and southeasterly exposures would approach the midway point, or average conditions for seedling establishment and survival.

Douglas-fir Type Group in California

Prospective stocking was estimated by a system similar to that used in the Pacific Northwest, i.e., by giving weighted ratings to seed source, seedbed, slope and exposure.

Seed source standards--the basis for rating seed source in California for the Douglas-fir type group follows:

Rating value	Number of tree heights from timber edge	Supplemental allowance
4 (Good)	0 to 3	A value of 1 was allowed for each seed tree within one tree height of point. Exceptionally good seed trees were given a value of 2. Outside of blister rust control areas, sugar pines were not counted as seed trees.
3 (Fair)	4 to 5	
2 (Poor)	6 to 7	
0	over 7	

As was the case in the Pacific Northwest, no combined rating of seed source was given a total value of more than 4, and any point with a "zero" rating for seed source was classed as "no stocking in prospect."

Seedbed-slope and exposure--the data on pages 54 and 55 for the Pacific Northwest also were used for rating these factors in the Douglas-fir type of California.

Other Type Groups in the Pacific Northwest and California Regions

Seed-source standards--seed sources judged adequate for the ponderosa and lodgepole pine types in the Pacific Northwest, and for the ponderosa, western white pine, fir-spruce and redwood forest type groups in California, when in combination with favorable seedbed conditions, are summarized as follows:

Forest type group and region	Maximum effective seeding distance of scattered seed trees: Diameter breast high (inches)	Distance (feet)	Maximum effective seeding distance from timber edge
East side ponderosa pine in California; all ponderosa pine in Pacific Northwest	12 to 16	40	Two tree heights from stands containing a fair proportion of trees 12 inches in d.b.h. and larger that meet the seed tree definition
	18 to 24	50	
	26+	70	
West side ponderosa pine, western white pine and fir-spruce in California	18 to 24	50	Two tree heights from stands containing a fair proportion of trees 18 inches in d.b.h. and larger that meet the seed tree definition
	26+	70	
Redwood	..	1/ 60	Two tree heights from stands of mature timber
Lodgepole pine	6+	(2/)	Two tree heights

1/ Must be capable of bearing seed. Fire columns were not counted as seed bearers until after 10 years of new crown growth.
2/ Two or more seed trees within one tree height of point were considered an effective seed source.

Seedbed condition--standards for favorable seedbed conditions in the remaining type groups of these two regions were as follows:

(a) Ponderosa pine--the seedbed was considered favorable when on Site III (Index 84) and better at least 25 percent of the 4-milacre quadrat surrounding the observation point was free of brush, sod or other limiting cover or when on poorer sites at least 50 percent of the milacre quadrat was free of sod, brush or other limiting cover, showed evidence of scarification from logging

or other reduction of competition and the area surrounding the quadrat contained regeneration established at intervals not exceeding 10 years. Unstocked sample points in the ponderosa type which were supplied with the minimum sources of seed described in the preceding tabulation and on which the above seedbed conditions prevailed were classed as "stocking in prospect." If either the seed source or seedbed were inadequate by these standards, the point was classed as "stocking not in prospect."

(b) Western white pine (sugar pine) and fir-spruce forest type groups--here unstocked points supplied with at least the minimum seed source described in the preceding tabulation and with seedbed conditions described above as adequate for ponderosa Site III and better were classed as "stocking in prospect." Otherwise they were classed as "stocking not in prospect."

(c) Redwood type--here unstocked points supplied with at least the minimum seed source described in the preceding tabulation were classed as "stocking in prospect" if the 4-milacre plot surrounding the point had been scarified or had ground competition significantly reduced by logging, was at least 60 percent free of perennial grasses, dense to moderately dense herbaceous growth, overtopping shrubs and noncrop trees.

(d) Lodgepole pine forest type group--here unstocked points having at least the minimum seed source described in the preceding tabulation were classed as "stocking in prospect" if the milacre plot surrounding the point were at least 50 percent free of brush, sod or other limiting cover. Otherwise the points were classed as "stocking not in prospect."

Hemlock-Sitka Spruce Type Group in Coastal Alaska

Determination of prospective stocking was based upon the sum of ratings for seed source and for seedbed condition. If this sum was 5 or greater the point was classed as "stocking in prospect." If the sum was 4 or less the point was classed "no stocking in prospect."

Seed source standards--the basis for rating seed source in Coastal Alaska is summarized below:

Rating value	Number of tree heights from tree edge
4 (Good)	0 to 4
3 (Fair)	5 to 8
2 (Poor)	9 to 11
0	11+

In addition to the above values for distance to timber edge, a value of 1 was allowed for each seed tree within one tree height of a sample point in Alaska. Exceptionally good seed trees within this distance were given a value of 2 in the rating. In no case was a combined rating of seed source given a total value of more than 4.

Seedbed condition--the seedbed standards used are shown on page 54 and the procedure and methods of rating were the same as those used for type groups west of the Cascade summit in the Pacific Northwest Region.

Effect of Felling Age

In the Pacific Northwest and California Regions, calculation of felling age effects were completed in the field by each examiner during early stages of the survey. Later, field examiners recorded the data necessary for the calculations which were then completed in the Washington office of the Forest Service, following the procedures and tabular guides outlined in the criteria for the two regions. Table 23 presents the factors applied for determination of felling age effects.

West Coast Supplementary Study

For all of the area in Washington, Oregon, and California sampled after March 12, 1954, data supplementary to that required by standard procedures were recorded. These data were as follows:

(1) Felling age of trees cut was recorded at each examination point, regardless of stand age or type of cutting.

(2) At each observation point, information was recorded on forest type, site quality class, and whether clear cutting or partial cutting had been applied.

(3) For points recorded as nonstocked, the reasons for lack of existing and prospective stocking were recorded.

(4) The tree species that stocked each examination point before cutting as well as the species that stocked the point at time of examination were both recorded.

These supplemental records were taken on about 95 percent of the forest area sampled in Washington and Oregon and on about 35 percent of the area sampled in California. The results are presented in the section, "Condition of Recently Cutover Lands," Chapter IV, along with the results of the standard study.

Table 23.--Percentage of mean annual increment at culmination attained at various ages, by forest type group,[1/] subregion, and size class of products cut, Pacific Northwest and California Regions

Age (years)	Douglas-fir, hemlock-Sitka spruce, and western white pine types					Ponderosa pine and western larch types				Ponderosa pine type	
	Pacific Northwest and California[2/]					Pacific Northwest				California	
	Sawlogs[3/]				Cordwood	Sawlogs[4/]			Cordwood	Sawlogs[4/]	
	Site I[3/]	Site II	Site III	Site IV & V	All sites	Site[6/] II & III	Site IV	Site V & VI	All sites	East side[7/]	West side[8/]
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
20	..	..	..	..	18	..	..	..	..	..	..
30	25	10	..	..	50	10	..	..	25	..	..
40	56	35	19	..	78	28	7	..	57	..	41
50	79	64	41	20	92	47	20	..	80	34	61
60	91	82	66	41	99	64	38	..	93	52	76
70	97	92	82	60	100	77	54	10	96	68	86
80	100	98	92	75	..	86	68	17	100	79	93
90	..	100	98	86	..	92	79	26	..	88	97
100	..	..	100	93	..	96	88	34	..	93	99
110	..	..	..	97	..	99	93	43	..	97	100
120	..	..	..	99	..	100	97	52	..	99	..
130	..	..	..	100	..	..	99	62	..	100	..
140	..	..	..	..	..	..	100	71	..	..	..
150	..	..	..	..	..	..	..	80	..	..	..
160	..	..	..	..	..	..	..	86	..	..	..
170	..	..	..	..	..	..	..	92	..	..	..
180	..	..	..	..	..	..	..	100	..	..	..

1/ Factors for felling age were not applied in the types not shown in the table.
2/ For Douglas-fir in California the factors for site index III only were used.
3/ International rule, 1/4-inch kerf.
4/ Scribner rule.
5/ Based on site classification in U.S.D.A. Tech. Bul. 201.
6/ Based on site classification in U.S.D.A. Tech. Bul. 630.
7/ These standards were used for ponderosa pine stands where site index was 98 feet or less at 100 years.
8/ These standards were used for ponderosa stands where site index was greater than 98 feet at 100 years.

Forest Type Groups

The following forest types were recognized in this region:

- Ponderosa pine
- Western larch
- Douglas-fir
- Fir-spruce
- Lodgepole pine
- Western white pine
  - a. Inside blister rust control units
  - b. Outside blister rust control units
- Aspen

Species Classification

The species classification used in this region is shown in table 24 by type group and locality. Where locality is not specified in the table or footnote thereto, the classification was applied regionwide.

Existing Stocking

Table 25 shows the standards used to determine existing stocking at each point. Seedlings, saplings, and, in some instances, poles were counted if they fell within 1, 2, or 4-milacre circular plots, as specified in the table by the distances 3.7, 5.3, and 7.4 feet, respectively, from the point. Larger trees were counted if they fell within the specified distance from the point as shown for each d.b.h. class in the table.

The following tabulation relates the entries in table 25 for seedlings and saplings to conventional measures by the stocked-quadrat method:

Entries from table 25: Minimum trees per acre (number)	Entries from table 25: Maximum distance from point (feet)	Equivalent minimum of trees per quadrat required for a stocked point (number)
1000	3.7	1 per 1-milacre quadrat
1000	5.3	2 per 2-milacre quadrat
500	5.3	1 per 2-milacre quadrat
250	7.4	1 per 4-milacre quadrat

Table 24.--Classification of species according to forest type,[1] Northern Rocky Mountain Region

Species	Western white pine type		Ponderosa pine type	Larch type	Douglas-fir type	Spruce-fir type	Spruce-fir type[2]	Lodgepole pine type				Ponderosa pine type (Black Hills)
	Inside b.r.c. units	Outside b.r.c. units				Low elevation western Montana and northern Idaho		Low elevation western Montana and northern Idaho	High elevation western Montana and northern Idaho	Southern Idaho and Wyoming, west of Divide	Wyoming, east of Divide	
Douglas-fir	A	D	A	A	D	A	A	D	A	D	..	..
Fir, alpine	..	..	..	..	..	..	A[3]	..	A[3]	A	A	..
Fir, grand	A	D	..	A	A	A	..	..	..	A	..	..
Hemlock, western	A[4]	..	..	..	..	..	..	..	..	..	..	..
Larch, western	A	D	D	D	D	A or D[5]	A	D	..	D	..	..
Pine, lodgepole	A	A	A	A	A	A	D	A	D	D	D	..
Pine, ponderosa	A	A	D	A	D	..	..	D	..	D	..	D
Pine, western white	D	D[6]	A[6]	A[6]	A[6]	D[6]	..	A[6]	..	..	..	..
Redcedar, western	A	D	A	A	A	D	..	..	..	..	..	..
Spruce, black hills	..	..	..	..	..	..	..	..	..	..	..	A
Spruce, Engelmann	A	D	A	D	A	D	D	A	A	D	D	..
Hardwoods	A[7]	A[7]	..	..	..	..	..	..	..	..	..	..

A = Acceptable D = Desirable

1/ Aspen type; all species in type were desirable.

2/ In southern Idaho and in Wyoming, west of Continental Divide, any species found in the spruce-fir type which exhibited growth characteristics of such quality as to make it marketable in the immediate locality, except timber and white bark pine, were considered desirable.

3/ When alpine fir was reserved for watershed protection, it was considered acceptable in this type.

4/ Western hemlock was considered acceptable when it was reserved for shade in Ribes control. Otherwise it was a noncount.

5/ On moist areas near stream bottoms and meadows where water is close to the ground surface, larch was classified as acceptable because in such situations it suffers from disease.

6/ Western white pine under 12 inches d.b.h. was not counted outside of blister rust protection units because survival in such situations is highly questionable. When trees over 12 inches d.b.h. were found in this type they were classified as shown in the table.

7/ Cottonwood was considered acceptable in localities where it was being utilized; otherwise it was considered a noncount species.

Table 25.--Minimum number of trees per acre and maximum distances from observation point used in classifying existing stocking in the Northern Rocky Mountain Region, by tree age or size, forest type, and by subregion

Age or size of established seedling or sapling and crop tree d.b.h.	Ponderosa pine, western larch, and Douglas-fir type 1/		Spruce-fir (high elevation, Montana and northern Idaho)		Spruce-fir (low elevation western Montana, Idaho and western Wyoming) or: western white pine		Lodgepole pine type 1/		Ponderosa pine type (Black Hills)		Aspen type	
	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point
	Number	Feet	Number	Feet	Number	Feet	Number	Feet	Number	Feet	Number	Feet
1 yr. old to 2.5" d.b.h.	..	..	..	..	..	..	..	..	1,000	2/3.7	1,000	3.7
1 yr. old to 0.5' high	1,000	5.3	1,000	5.3	..	..	..	..	..	..	..	..
1 yr. old to 4.5" d.b.h.	..	..	..	..	1,000	3.7	1,000	2/3.7	..	..	..	..
0.5' high to 4.5" d.b.h.	500	5.3	500	5.3	..	..	..	..	..	..	..	..
4.6" to 8.5" d.b.h.	250	7.4	..	..	..	..	..	..	..	..	..	..
4.6" to 9.5" d.b.h.	..	..	250	7.4	500	5.3	..	..	..	..	..	..
1" d.b.h.	..	..	..	..	..	..	..	..	..	..	900	3.9
2	..	..	..	..	..	..	..	..	..	..	800	4.1
3	..	..	..	..	..	..	..	..	800	4.2	700	4.5
4	..	..	..	..	..	..	..	..	680	4.5	600	4.8
5	..	..	..	..	..	..	941	3.8	555	5.0	440	5.7
6	..	..	..	..	..	..	653	4.6	435	5.7	360	6.2
7	..	..	..	..	..	..	479	5.4	325	6.5	280	7.1
8	..	..	..	..	..	..	367	6.2	220	7.9	230	7.7
9	215	8.0	..	..	..	..	290	6.9	185	8.7	180	8.8
10	174	8.9	202	8.3	278	7.0	235	7.7	155	9.5	150	9.6
12	121	10.7	141	9.9	194	8.5	163	9.2	125	10.5	110	11.2
14	89	12.5	103	11.6	143	9.9	120	10.8	90	12.4	80	13.2
16	68	14.3	79	13.2	109	11.3	92	12.3	55	15.9	60	15.2
18	54	16.1	62	14.9	86	12.7	72	13.8	46	17.4	48	17.0
20	44	18.1	50	16.6	70	14.1	59	15.3	38	19.1	..	..
22	36	19.6	43	18.2	58	15.5	..	..	30	21.5	..	..
24	30	21.5	35	19.8	49	16.9	..	..	..	..	..	..
26	26	23.1	30	21.5	41	18.3	..	..	..	..	..	..
28	22	25.1	25	23.2	36	19.7	..	..	..	..	..	..
30	19	27.0	22	24.8	31	21.1	..	..	..	..	..	..
32	17	28.6	20	26.5	27	22.5	..	..	..	..	..	..
34	15	30.3	17	28.2	24	23.9	..	..	..	..	..	..
36	13	32.6	16	29.8	22	25.4	..	..	..	..	..	..
38	12	34.0	..	..	..	..	..	..	..	..	..	..
40	11	35.5	..	..	..	..	..	..	..	..	..	..
40+	8	41.6	..	..	..	..	..	..	..	..	..	..

1/ Understory larch and Douglas-fir trees and lodgepole pine that occurred in the immediate vicinity or within 40 feet of mistletoe-infected overstory trees were not counted.

2/ Points were considered seriously overstocked and disqualified from the count when the following conditions prevailed:

Size class	Trees per milacre exceeded
1 yr. old to 1 foot high	20
1 foot high to 1 inch d.b.h.	10

Prospective Stocking

Seed sources available and seedbed conditions existing at unstocked sample points were carefully observed. If both seed source and seedbed were found adequate by the following standards, the point was classed as "stocking in prospect." If either seed source or seedbed, or both, were judged inadequate, the point was classed as "no stocking in prospect."

Table 26 shows the standards used for determining the adequacy of the seed supply. Seedbed was considered adequate only where 50 percent or more of the surface area of the quadrat surrounding the sample point was free of limiting cover such as rock, grass, shrubs, and if the point did not fall on permanent road surfaces, rock or water, etc. For the spruce type in south Idaho and Wyoming west of the Continental Divide, 1- and 2-milacre quadrats were used for this determination. With this exception, 4-milacre quadrats were used in all types and localities for determination of seedbed condition.

Examiners were instructed to observe the effects of deer browsing, particularly in the ponderosa pine type, and to record instances where it was believed to be serious. In north Idaho and Montana, when points fell in areas of very heavy deer browsing they were not considered for prospective stocking unless the point happened to fall in a location protected from the deer. Examiners were likewise instructed to observe signs of unusual rodent activities which might affect availability of seed for germination.

Prospects of stocking by Douglas-fir and lodgepole pine were not considered at points which fell in the immediate vicinity or within 40 feet of mistletoe-infected overstory trees.

Effect of Felling Age

Whenever clear cuttings were encountered in stands below rotation age, appropriate adjustment factors were recorded. Separate rotation age and adjustment factors were used depending upon whether the owner was producing cordwood products or sawtimber. Table 27 shows the adjustment factors used by location and type within the region.

Table 26.--Effective seeding distance for individual seed trees and for green timber edges, by species or forest type, and tree size, Northern Rocky Mountain Region

Species of seed tree or forest type	Seed trees: Diameter breast high	Seed trees: Maximum distance from point	Timber edges: Maximum distance from point in multiples of tree height
	Inches	Feet	
Western white pine	16 and larger	50	2
Ponderosa pine	12 - 16	40	2
	18 - 24	50	
	26 and larger	70	
Douglas-fir	10 - 14	50	2
	16 and larger	60	
Grand fir	16 and larger	50	2
Western larch	14 - 18	50	3
	18 and larger	60	
Spruce	18 and larger	60	3
Cedar	16 and larger	130	4
Lodgepole pine	10 and larger	1/40	1/2 ch.
Aspen		2/30	..

1/ When examining points for prospective stocking, ordinarily no allowance was made for standing individual lodgepole pine trees. The seed source was considered adequate only if cone-bearing slash less than 5 years old was present on ground at the point, or if the point lay within 2 chains of a standing body of green timber. In western Montana and north Idaho, scattered seed trees were considered only when full-crowned, vigorous, and windfirm, and within the distance from the point shown in the table.

2/ This distance refers to the stump of a recently cut tree. Major reliance for reproduction in aspen is placed on root suckers--not seed.

Table 27.--Percentage of mean annual increment at culmination attained at various ages, by forest type group, subregion, and size class of products cut, Northern Rocky Mountain Region

Age (years)	Ponderosa pine, larch, and Douglas-fir types					White pine type	Lodgepole pine type					
	Northern Idaho and Montana		Southern Idaho and Wyoming west of Divide	Wyoming, east of Continental Divide			Low elevations, western Montana and northern Idaho		High elevations, northern Idaho and Montana		Wyoming, east of Continental Divide	
	Sawtimber	Cordwood	Sawtimber	Sawtimber	Cordwood	Sawtimber	Sawtimber	Cordwood	Sawtimber	Cordwood	Sawtimber	Cordwood
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
40	..	50	4	..	43	..	10	60	..	50	..	48
50	10	60	15	..	83	20	30	70	20	60	18	61
60	20	70	28	..	95	40	50	80	40	70	40	72
70	30	80	46	15	100	60	70	90	60	80	60	81
80	40	90	60	45	..	70	90	100	80	90	75	88
90	50	100	73	60	..	80	90	..	80	100	85	95
100	60	..	83	72	..	90	100	..	90	..	92	100
110	70	..	90	83	..	100	..	..	90	..	96	..
120	80	..	95	90	..	100	..	..	100	..	99	..
130	90	..	98	95	..	..	..	..	..	..	100	..
140	90	..	100	97	..	..	..	..	..	..	..	..
150	100	..	..	98	..	..	..	..	..	..	..	..
160	..	..	..	100	..	..	..	..	..	..	..	..

Forest Type Groups

The following forest types were recognized in this region:

Ponderosa pine
Douglas-fir
Lodgepole pine
Fir-spruce
Aspen
Elm-ash-cottonwood
  Cottonwood subtype

Standards for the cottonwood subtype used in this region were the same as those described for this subtype in the criteria for the Plains Region.

Species Classification

In the examination of points, species desirability was determined according to the classification shown in table 28.

Existing Stocking

Table 29 shows by forest type group and geographic location the standards used to determine stocking at each point. Seedlings, saplings, and, in some instances, poles were counted if they fell within 1, 2, or 4-milacre plots as indicated in the table. Larger trees were counted if they were located within the maximum distance from the point indicated for each d.b.h. class. The following tabulation relates the entries in table 29 for seedlings, poles, and saplings, to conventional measures by the stocked quadrat method:

Entries from table 29		
Minimum trees per acre (number)	Maximum distance from point (feet)	Equivalent minimum of trees per quadrat required for a stocked point (number)
1000	3.7	1 per 1-milacre quadrat
1000	5.3	2 per 2-milacre quadrat
500	5.3	1 per 2-milacre quadrat
250	7.4	1 per 4-milacre quadrat

Table 28.--Classification of species according to timber type[1] and locality, Southern Rocky Mountain Region

Species	Ponderosa pine type				Douglas-fir type	Fir-spruce type[2]		Lodgepole pine type		Elm-ash-cottonwood
	Arizona and New Mexico[3]	Southwestern Colorado and east slope of Rocky Mtn.	Western Nevada	Utah and Nevada (south)	Utah and Nevada	Colorado [4]	Arizona and New Mexico[3]	Colorado [1]	Utah and Nevada	Colorado
Cottonwood	..	..	..	..	..	..	..	..	..	D
Douglas-fir	D	A	A	A	D	..	D	..	D	..
Fir, alpine	A	..	..	A	A[5]	A	A	A	A	..
Fir, grand	A	..	A	..	A	..	A	..	A	..
Fir, red	..	..	A[5]	..	..	..	..	..	..	..
Fir, white	..	..	A[5]	A	A[5]	..	..	..	..	..
Incense-cedar	..	..	A[5]	..	..	..	..	..	..	..
Larch	..	..	A	..	D	..	..	..	D	..
Pine, lodgepole	..	A	A	A	A	D	..	D	D	..
Pine, ponderosa	D	D	D	D	D	..	..	..	D	..
Pine, Jeffrey	..	..	D	..	..	..	..	..	..	..
Pine, sugar	..	..	D	..	..	..	..	..	..	..
Pine, western white	..	..	A	..	..	..	..	..	..	..
Spruce, blue	A	A	..	..	A[5]	..	A	..	..	..
Spruce, Engelmann	A	A	A	A	D	D	D	D	D	..

D = desirable species   A = acceptable species

1/ Aspen type: All species classed desirable.
2/ Fir-spruce type--Utah and Nevada: All species classed desirable if marketable locally except lumber and white bark pine, which are noncount species.
3/ All pines except pinyon were classified desirable for the type.
4/ All conifers not listed for the type were considered desirable.
5/ Classified acceptable only if marketable under local conditions--otherwise as noncount.

Table 29.--Minimum number of trees per acre and maximum distances from observation point used in classifying existing stocking in the Southern Rocky Mountain Region, by tree age or size, forest type, and subregion

Age or size of established seedling or sapling and crop tree d.b.h.	Ponderosa pine, Douglas-fir types		Ponderosa pine type		Lodgepole pine type1/		Aspen type		Fir-spruce type					
	Western Nevada		Entire region except western Nevada		Entire region		Entire region		Utah, Ariz., N.M., Colorado, south of Gunnison River		Colorado, north of Gunnison River		Western Nevada	
	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point
	Number	Feet	Number	Feet	Number	Feet	Number	Feet	Number	Feet	Number	Feet	Number	Feet
1 year to 6" high	1,000	5.3	..	..	..	..	..	..	..	..	..	..	..	..
6" high to 4.5" d.b.h.	500	5.3	..	..	..	...	..	..	..	..	..	..	..	..
1 year to 4.5" d.b.h.	..	..	..	..	..	..	..	..	..	..	..	..	1,000	3.7
4.6" d.b.h. to 8.5" d.b.h.	250	7.4	..	..	..	..	..	..	..	..	..	..	..	..
4.6" d.b.h. to 9.5" d.b.h.	..	..	..	..	..	..	..	..	..	..	..	..	500	5.3
Seedling to 0.5" d.b.h.	..	..	..	..	..	..	1,000	3.7	..	..	..	..	..	..
Seedling to 1.0" d.b.h.	..	..	500	5.3	..	..	..	..	..	..	..	..	..	..
Seedling to 4" d.b.h.	..	..	..	..	1,000	3.7	..	..	..	..	..	..	..	..
Seedling to 5" d.b.h.	..	..	..	..	..	..	..	..	..	..	1,000	3.7	..	..
Seedling to 6" d.b.h.	..	..	..	..	..	..	..	..	500	5.3	..	..	..	..
1" d.b.h.	..	..	..	..	..	..	900	3.9	..	..	..	..	..	..
2	..	..	..	..	..	..	800	4.1	..	..	..	..	..	..
2 and 3	..	..	250	7.4	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	700	4.5	..	..	..	..	..	..
4	..	..	218	8	..	..	600	4.8	..	..	..	..	..	..
5	..	..	171	9	941	3.8	440	5.7	..	..	..	..	...	..
6	..	..	139	10	653	4.6	360	6.2	..	..	560	5.0	..	..
7	..	..	114	11	479	5.4	280	7.1	..	..	..	..	..	..
8	..	..	104	12	367	6.2	230	7.7	280	7.1	315	6.6	..	..
9	215	8.0	82	13	290	6.9	180	8.8	..	..	..	..	..	..
10	174	8.9	70	14	235	7.7	150	9.6	180	8.8	202	8.3	278	7.0
12	121	10.7	62	15	163	9.2	110	11.2	125	10.6	141	10.0	194	8.5
14	89	12.5	48	17	120	10.8	80	13.2	92	12.4	103	11.6	143	9.9
16	68	14.3	38	19	92	12.3	60	15.2	70	14.0	79	12.9	109	11.3
18	54	16.1	32	21	72	13.8	48	17.0	56	15.8	62	15.0	86	12.7
20	44	17.1	29	22	59	15.3	..	..	45	17.6	50	16.8	70	14.1
22	36	19.6	24	24	..	..	..	..	37	19.4	43	18.0	58	15.5
24	30	21.5	20	26	..	..	..	..	31	21.0	35	19.8	49	16.9
26	26	23.1	18	28	..	..	..	..	27	22.8	30	22.3	41	18.3
28	22	25.1	16	29	..	..	..	..	23	24.6	25	23.6	36	19.7
30	19	27.0	14	31	..	..	..	..	20	26.3	22	25.1	31	21.1
32	17	28.6	13	33	..	..	..	..	18	28.1	20	26.4	27	22.5
34	15	30.3	11.4	35	..	..	..	..	16	29.8	17	28.5	24	23.9
36	13	32.6	10.7	36	..	..	..	..	14	31.6	16	29.4	22	25.4
38	12	34.0	9.6	38	..	..	..	..	12	33	..	..	..	..
40	11	35.5	8.7	40	..	..	..	..	11	35	..	..	..	..
40 - 50	8	41.6	..	..	..	..	..	..	..	..	..	..	..	..

1/ Overstocking was considered the equivalent of nonstocking under the following conditions: (a) 20 or more seedlings 4 inches to 12 inches high per milacre quadrat, (b) 10 or more trees 12 inches high to 1 inch d.b.h. per milacre quadrat.

Prospective Stocking

The procedure followed in determining the prospects of future stocking at unstocked points in the Southern Rocky Mountain Region was similar to that for the Northern Rocky Mountain Region. The standards used for determining adequacy of the seed supply were as follows:

Standards for determining prospective stocking, based on proximity to seed source

	Maximum distance of seed trees from point (feet)
Ponderosa pine--Nevada, Utah, southwest Colorado, and east slope of Rockies:	
12 to 16 inches d.b.h.	40
18 to 24 inches d.b.h.	50
26 inches d.b.h. and larger	70
Ponderosa pine--Arizona and New Mexico:	
18 inches d.b.h. and larger	50
Douglas-fir:	
10 to 14 inches d.b.h.	50
16 inches d.b.h. and larger	60
Aspen	1/ 30

	Maximum distance of timber edges in multiples of tree height
Douglas-fir	2
Lodgepole pine	(2/)
Fir-spruce	3/ 3

1/ This distance refers to the stump of a recently cut tree. Major reliance for reproduction in aspen is placed on root suckers--not seed.

2/ Individual seed trees not considered as seed sources because of lack of windfirmness after cutting. The seed source was considered adequate only if cone-bearing slash less than 5 years old was present on the ground at the point or if a timber margin of cone-bearing trees was located within 2 chains of the point.

3/ Individual seed trees considered adequate seed sources only in occasional instances where windfirm after cutting. In Colorado where partial cutting removed less than 50 percent of the volume, seed sources were considered adequate. Maximum distance of 12-inch d.b.h. and larger seed trees from point in multiples of tree height, 1. Adjacent bodies of timber were considered adequate seed sources only when at least 60 years of age and judged to be windfirm.

Seedbed was considered adequate only where the 4-milacre plot surrounding a sample point was not more than 50 percent occupied by brush, grass, sod, weeds, rock, water, road surface, and other limiting cover. In Colorado, Arizona, and New Mexico it was in addition required that the plot be affected by logging through removal of trees, shrubs and other vegetative competition or by scarification in order to qualify as an adequate seedbed. In Utah and Nevada the examiner was especially instructed to observe site factors, inherent or introduced, which adversely affected the establishment of seedlings. Some of the factors considered were degree of slope, exposure, soil characteristics, browsing and/or trampling by grazing animals and rodent damage. In the determination of prospective stocking, these factors were weighed and a decision was based on experience and judgment of the field examiner with respect to the factors enumerated.

Effect of Felling Age

The factors shown in table 30 were used to determine the effect of felling age. Only a limited amount of cutting in second-growth stands occurs in the Southern Rocky Mountain Region. Therefore, table 30 presents data only for those type groups, localities, and products size classes where such cutting was expected to be encountered during field examination.

Table 30.--Percentage of mean annual increment at culmination attained at various ages, by forest type group, subregion, and size class of products cut, Southern Rocky Mountain Region

Age (years)	Ponderosa pine type				Lodgepole pine type	
	Utah and Nevada	South Colorado slope	West and east slope	Arizona and New Mexico	Colorado 1/	
	Sawtimber	Sawtimber	Cordwood	Sawtimber	Sawtimber	Cordwood
	Percent	Percent	Percent	Percent	Percent	Percent
40	4	..	43	..	..	48
50	15	..	83	34	18	61
60	28	..	95	52	40	72
70	46	15	100	68	60	81
80	60	45	..	79	75	88
90	73	60	..	88	85	95
100	83	72	..	93	92	100
110	90	83	..	97	96	..
120	95	90	..	99	99	..
130	98	95	..	100	100	..
140	100	97	..	..	..	..
150	..	98	..	..	..	..
160	..	100	..	..	..	..

1/ Effect of felling age not considered elsewhere in lodgepole pine type.

BIBLIOGRAPHY

The following references were used as sources of information in preparing the standards for rating productivity of recently cutover lands. Some of the published data were modified by using more recent information from the forest experiment stations and other sources to adapt them to the varied characteristics of the type groups in different parts of the country.

Existing Stocking

1. Bruce, Donald.
   Preliminary yield tables for second-growth redwood. Univ. Calif. Press Bul. 361. 1923.

2. Eyre, F. H., and Zehngraff, Paul.
   Red pine management in Minnesota. U. S. Dept. Agr. Cir. 778. 1948.

3. Forbes, R. D., and Bruce, Donald.
   Rate of growth of second-growth southern pine in full stands. U. S. Dept. Agr. Cir. 124. 1930.

4. Gevorkiantz, S. R., and Guilkey, P. C.
   Allowable cut. Unpublished report of the Lake States Forest Expt. Sta. 1949.

5. Haig, I. T.
   Second growth yield, stand, and volume tables for the western white pine type. U. S. Dept. Agr. Tech. Bul. 223, 68 pp. 1932.

6. Lexen, Bert.
   Space requirements of ponderosa pine by tree diameter. Southwestern Forest and Range Expt. Sta. Research Note 63. 1939.

7. Mason, D. T.
   Utilization and management of lodgepole pine in the Rocky Mountains. U. S. Dept. Agr. Bul. 234. 1915.

8. McArdle, R. E., Meyer, W. H., and Bruce, Donald.
   The yield of Douglas-fir in the Pacific Northwest. U. S. Dept. Agr. Tech. Bul. 201. 1930.

9. Meyer, Walter H.
   Yield of even-aged stands of ponderosa pine. U. S. Dept. Agr. Tech. Bul. 630. 1934.

10. Minckler, Leon S.
   Characteristics of unmanaged well-stocked stands and interim stocking guides for some upland central hardwood forests. Presented at annual meeting of Soc. of Amer. Foresters, Washington, D. C. 1950.

11. Pearson, G. A.
Ponderosa pine management in the Southwest. U. S. Dept. Agr. Monog. 6. 1952.

12. Pole Blight Investigation Steering Committee.
Pole blight--what is known about it. North. Rocky Mtn. Forest and Range Expt. Sta. Misc. Pub. 4. 1952.

13. Putnam, J. A.
Cutting schedule for even-aged bottomland hardwoods. Jour. Forestry 50: 866. 1952.

14. U. S. Forest Service.
Forest Survey Field Manual. April 1952. [Processed.]

15. ______
Sugar pine delineation manual. 1952. [Processed.]

16. ______
1950 annual report of the Southwestern Forest and Range Experiment Station. "Test of validity of the point system." [Processed.]

17. Whitney, C. N.
Normal yield tables--lodgepole pine. North. Rocky Mtn. Forest and Range Expt. Sta. 1913. [Processed.]

18. Ziegler, E. Z.
Forest tables--lodgepole pine. U. S. Forest Service Circular 126. 1907.

Prospective Stocking

19. Barrett, L. I.
Observations on requirements for restocking cut-over loblolly and shortleaf pine stands. Appalachian Forest Expt. Sta. Tech. Note 42. 1940.

20. Boe, Kenneth N.
Western larch and Douglas-fir seed dispersal into clear cuttings. North. Rocky Mtn. Forest and Range Expt. Sta. Res. Note 29. 1952. (Note: these data were used in T.R.R. Task VIII before publication.)

21. Douglas-fir Second-Growth Management Committee.
Management of second-growth forests in the Douglas-fir region. Pacific Northwest Forest and Range Expt. Sta. December 1947. [Processed.]

22. Downs, A. A.
Seed production of Appalachian oak. Jour. Forestry 42 (12). 1944.

23. Eyre, F. H., and LeBarron, Russell K.
Management of jack pine stands in the Lake States. U. S. Dept. Agr. Tech. Bul. 863. 1944.

24. Haig, I. T., Davis, K. P., and Weidman, R. H.
Natural regeneration in the western white pine type. U. S. Dept. Agr. Tech. Bul. 767. 1941.

25. Isaac, Leo A.
Reproductive habits of Douglas-fir. Pack Foundation. Washington, D. C. 1943.

26. Larson, J. A.
Silvics of western larch. Soc. Amer. Foresters Proc. 11: 434-440. 1916.

27. LeBarron, R. K.
Silvicultural practices for lodgepole pine in Montana. North. Rocky Mtn. Forest and Range Expt. Sta. Sta. Paper 33.

28. ________
Review of published information on the larch-Douglas-fir type. North. Rocky Mtn. Forest and Range Expt. Sta. Sta. Paper 15. 1948.

29. Liming, Franklin G., and Johnson, John P.
Reproduction in oak-hickory forest stands of the Missouri Ozarks. Jour. Forestry 42 (3). 1944.

30. McCulley, R. D.
Management of natural slash pine stands in the flatwoods of South Georgia and northern Florida. U. S. Dept. Agr. Cir. 845. 1950.

31. Pomeroy, Kenneth B.
Loblolly pine seed tree selection, fruitfulness, and mortality. Southeastern Sta. Paper 5. 1949.

32. Roe, Arthur L.
Cutting practices in Montana larch-Douglas-fir. Paper presented at the annual meeting, Northwest Scientific Association. Spokane, Washington. 1953. [Unpublished.]

33. ________
Larch-Douglas-fir regeneration studies in Montana. Northwest Sci. 25: 95-102. 1951.

34. Trousdell, Kenneth B.
Seed and seedbed requirements to regenerate loblolly pine. Southeastern Sta. Paper 8. November 1950.

35. File material of Oregon State Board of Forestry and cooperating private owners.

36. File material and unpublished data of the:
Pacific Northwest Forest and Range Expt. Sta.
California Forest and Range Expt. Sta.
Northern Rocky Mountain Forest and Range Expt. Sta.
Rocky Mountain Forest and Range Expt. Sta.
Intermountain Forest and Range Expt. Sta.

Effect of Felling Age

37. Chaiken, L. E.
The approach of loblolly and Virginia pine stands toward normal stocking. Jour. For. pp. 866-871. 1939.

38. Eyre, F. H., and Zehngraff, Paul.
Red pine management in Minnesota. U. S. Dept. Agr. Cir. 778. 1948.

39. Gevorkiantz, S. R., and Scholz, H. F.
Timber yields and possible returns from mixed oak farmwoods of southwestern Wisconsin. Univ. Wis. Pub. 521. 1948.

40. Gevorkiantz, S. R., and Olson, Lucille P.
Growth and yield of upland balsam fir in the Lake States. Sta. Paper 22. Lake States Forest Expt. Sta. 1950.

41. Gevorkiantz, S. R., and Duerr, William A.
A yield table for northern hardwoods in the Lake States. Jour. Forestry 35. 1937.

42. ______
Volume and yield of northern white cedar in the Lake States. Lake States Forest Expt. Sta. 1939. [Processed report.]

43. Haig, I. T.
Second-growth yield, stand and volume tables for the western white pine types. U. S. Dept. Agr. Tech. Bul. 323. 1932.

44. LeBarron, Russell K.
Silvicultural management of black spruce in Minnesota. U. S. Dept. Agr. Cir. 791. 1948.

45. MacKinney, A. L., and Chaiken, L. E.
Volume, yield, and growth of loblolly pine in the Mid-Atlantic coastal region. Tech. Note 33, rev. 1949. Southeastern Forest Expt. Sta., Asheville, N. C.

46. McCarthy, E. F.
Yellow poplar characteristics, growth, and management. U. S. Dept. Agr. Tech. Bul. 356. 1933.

47. McArdle, R. E., Meyer, W. H., and Bruce, Donald.
The yield of Douglas-fir in the Pacific Northwest. U. S. Dept. Agr. Tech. Bul. 201. October 1930.

48. Meyer, Walter H.
Yield of even-aged stands of ponderosa pine. U. S. Dept. Agr. Tech. Bul. 630. 1934.

49. ______
Yield of even-aged stands of loblolly pine in northern Louisiana. Yale University Bul. 51. 1942.

50. Putnam, J. A.
Cutting schedule for even-aged bottomland hardwoods. Jour. Forestry p. 866. 1952.

51. Schnur, G. Luther
Yield, stand and volume tables for even-aged upland oak forests. U. S. Dept. Agr. Tech. Bul. 560. 1937.

52. Stoeckeler, J. H.
Yield table for cottonwood plantations. Tech. Note 268. Lake States Forest Expt. Sta. 1947.

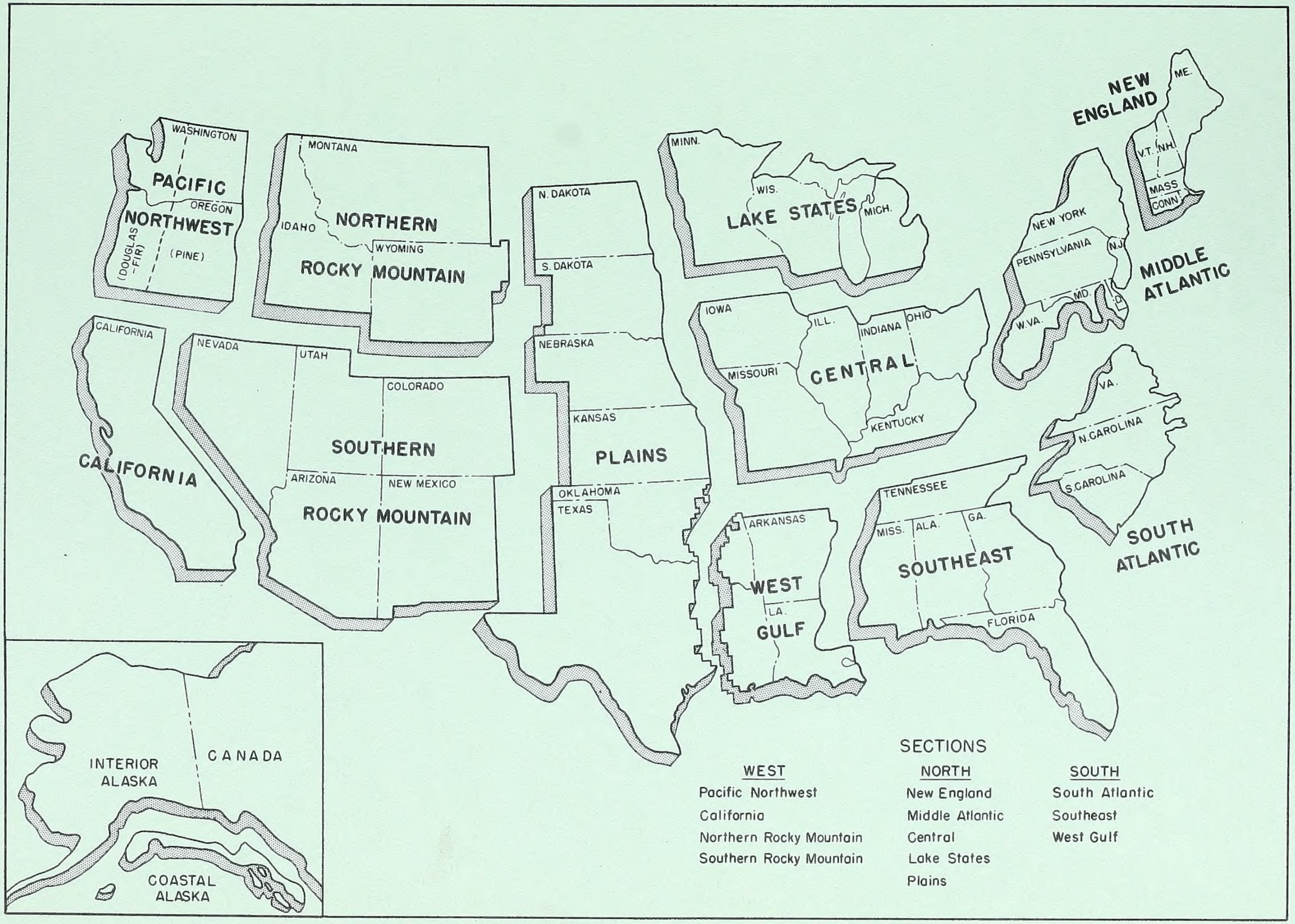
53. U. S. Forest Service.
Volume, yield, and stand tables for second-growth southern pines. U. S. Dept. Agr. Misc. Pub. 50. 1929.

54. Whitney, C. N.
Normal yield tables-lodgepole pine. Northern Rocky Mtn. Forest and Range Expt. Sta. 1913. [Processed.]

55. Winters, R. K., and Osborne, J. G.
Growth and yield of second-growth redgum in fully stocked stands on alluvial lands in the South. Occas. Paper 54. Southern Forest Expt. Sta., New Orleans, La. December 4, 1935.

56. Zehngraff, Paul J.
Possibilities of managing aspen. Lake States Aspen Rpt. 21. Lake States Forest Expt. Sta. 1947.

57. Zillgitt, W. M.
Basal area in merchantable trees as an expression of stocking in northern hardwoods. Tech. Note 324. Lake States Forest Expt. Sta. 1948.



Regions and Sections used in the Timber Resource Review